

# Rules and Regulations for the Classification of Ships for Service on the Great Lakes and River St. Lawrence

July 2015



Lloyd's  
Register

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# Rules and Regulations for the Classification of Ships for Service on the Great Lakes and River St. Lawrence

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# General Regulations

## Chapter 1

### Section 1

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### ■ Section 1 Background

1.1 Lloyd's Register Group Limited is a registered company under English law, with origins dating from 1760. It was established for the purpose of producing a faithful and accurate classification of merchant shipping. It now primarily produces classification Rules.

1.2 Classification services are delivered to clients by a number of other members subsidiaries and affiliates of Lloyd's Register Group Limited, including but not limited to: Lloyd's Register EMEA, Lloyd's Register Asia, Lloyd's Register North America, Inc., and Lloyd's Register Central and South America Limited. Lloyd's Register Group Limited, its subsidiaries and affiliates are hereinafter, individually and collectively, referred to as 'LR'.

### ■ Section 2 Governance

2.1 Lloyd's Register Group Limited is managed by a Board of Directors (hereinafter referred to as 'the Board').

The Board has:

appointed a Classification Committee and determined its powers and functions and authorised it to delegate certain of its powers to a Classification Executive and Devolved Classification Executives;

appointed Technical Committees and determined their powers, functions and duties.

2.2 LR has established National and Area Committees in the following:

Countries:	Areas:
Australia (via Lloyd's Register Asia)	Benelux (via Lloyd's Register EMEA)
Canada (via Lloyd's Register North America, Inc.)	Central America (via Lloyd's Register Central and South America Ltd)
China (via Lloyd's Register Asia)	Nordic Countries (via Lloyd's Register EMEA)
Egypt (via Lloyd's Register EMEA)	South Asia (via Lloyd's Register Asia)
Federal Republic of Germany (via Lloyd's Register EMEA)	Asian Shipowners (via Lloyd's Register Asia)
France (via Lloyd's Register EMEA)	Greece (via Lloyd's Register EMEA)
Italy (via Lloyd's Register EMEA)	
Japan (via Lloyd's Register Group Limited)	

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New Zealand (via Lloyd's Register Asia)

Poland (via Lloyd's Register (Polska) Sp zoo)

Spain (via Lloyd's Register EMEA)

United States of America (via Lloyd's Register North America, Inc.)

### ■ Section 3

#### Technical Committee

3.1 LR's Technical Committee is at present composed of a maximum of 80 members which includes:

*Ex officio members:*

- Chairman and Chief Executive Officer of Lloyd's Register Group Limited
- Chairman of the Classification Committee of Lloyd's Register Group Limited

*Members Nominated by:*

- Technical Committee
- Professional bodies representing technical disciplines relevant to the industry
- National and International trade associations with competence relevant to technical issues related to LR's business

3.2 In addition to the foregoing:

- (a) Each National or Area Committee may appoint a representative to attend meetings of the Technical Committee.
- (b) A maximum of five further representatives from National Administrations may be co-opted to serve on the Technical Committee. Representatives from National Administrations may also be elected as members of the Technical Committee under one of the categories identified in Pt 1, Ch 1, 3 Technical Committee.
- (c) Further persons may be co-opted to serve on the Technical Committee by the Technical Committee.

3.3 All elections are subject to confirmation by the Board.

3.4 The function of the Technical Committee is to consider:

- (a) any technical issues connected with LR's business;
- (b) any proposed alterations in the existing Rules;
- (c) any new Rules for classification;

Where changes to the Rules are necessitated by mandatory implementation of International Conventions and Codes, or Common Rules, Unified Requirements and Interpretations adopted by the International Association of Classification Societies, these may be implemented by LR without consideration by the Technical Committee, although any such changes will be provided to the Technical Committee for information.

Where changes to the Rules are required by LR to enable existing technical requirements within the Rules to be recognised as Class Notations or Descriptive Notes, these may be implemented by LR without consideration by the Technical Committee, although any such changes will be provided to the Technical Committee for information.

3.5 The term of office of the Chairman and of all members of the Technical Committee is five years. Members may be re-elected to serve an additional term of office with the approval of the Board. The term of office of the Chairman may be extended with the approval of the Board.

3.6 In the case of continuous non-attendance of a member, the Technical Committee may withdraw membership.

3.7 Meetings of the Technical Committee are convened as often and at such times and places as is necessary, but there is to be at least one meeting in each year. Urgent matters may be considered by the Technical Committee by correspondence.

3.8 Any proposal involving any alteration in, or addition to, Pt 1, Ch 1 General Regulations of Rules for Classification is subject to approval of the Board. All other proposals for additions to or alterations to the Rules for Classification other than Pt 1, Ch 1 General Regulations, will following consideration and approval by the Technical Committee either at a meeting of the Technical Committee or by correspondence, be recommended to the Board for adoption.

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3.9 The Technical Committee is empowered to:

- (a) appoint sub-Committees or panels; and
- (b) co-opt to the Technical Committee, or to its sub-Committees or panels, representatives of any organisation or industry or private individuals for the purpose of considering any particular problem.

### ■ Section 4

#### Naval Ship Technical Committee

4.1 LR's Naval Ship Technical Committee is at present composed of a maximum of 50 members and includes:

*Ex officio members:*

- Chairman and Chief Executive Officer of Lloyd's Register Group Limited

*Member nominated by:*

- Naval Ship Technical Committee;
- The Royal Navy and the UK Ministry of Defence;
- UK Shipbuilders, Ship Repairers and Defence Industry;
- Overseas Navies, Governments and Governmental Agencies;
- Overseas Shipbuilders, Ship Repairers and Defence Industries;

4.2 All elections are subject to confirmation by the Board.

4.3 All members of the Naval Ship Technical Committee are to hold security clearance from their National Authority for the equivalent of NATO CONFIDENTIAL. All material is to be handled in accordance with NATO Regulations or, for non-NATO countries, an approved equivalent. No classified material shall be disclosed to any third party without the consent of the originator.

4.4 The term of office of the Naval Ship Technical Committee Chairman and of all members of the Naval Ship Technical Committee is five years. Members may be re-elected to serve an additional term of office with the approval of the Board. The term of the Chairman may be extended with the approval of the Board.

4.5 In the case of continuous non-attendance of a member, the Naval Ship Technical Committee may withdraw membership.

4.6 The function of the Naval Ship Technical Committee is to consider technical issues connected with Naval Ship matters and to approve proposals for new Naval Ship Rules, or amendments to existing Naval Ship Rules.

4.7 Meetings of the Naval Ship Technical Committee are convened as necessary but there will be at least one meeting per year. Urgent matters may be considered by the Naval Ship Technical Committee by correspondence.

4.8 Any proposal involving any alteration in, or addition to, Pt 1, Ch 1 General Regulations of Rules for Classification of Naval Ships is subject to approval of the Board. All other proposals for additions to or alterations to the Rules for Classification of Naval Ships, other than Pt 1, Ch 1 General Regulations, will following consideration and approval by the Naval Ship Technical Committee, either at a meeting of the Naval Ship Technical Committee or by correspondence, be recommended to the Board for adoption.

4.9 The Naval Ship Technical Committee is empowered to:

- (a) appoint sub-Committees or panels; and
- (b) co-opt to the Naval Ship Technical Committee, or to its sub-Committees or panels, representatives of any organisation or industry or private individuals for the purpose of considering any particular problem.

### ■ Section 5

#### Applicability of Classification Rules and Disclosure of Information

5.1 LR has the power to adopt, and publish as deemed necessary, Rules relating to classification and has (in relation thereto) provided the following:



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- (a) Except in the case of a special directive by the Board, no new Regulation or alteration to any existing Regulation relating to classification or to class notations is to be applied to existing ships.
  - (b) Except in the case of a special directive by the Board, or where changes necessitated by mandatory implementation of International Conventions, Codes or Unified Requirements adopted by the International Association of Classification Societies are concerned, no new Rule or alteration in any existing Rule is to be applied compulsorily after the date on which the contract between the ship builder and shipowner for construction of the ship has been signed, nor within six months of its adoption. The date of 'contract for construction' of a ship is the date on which the contract to build the ship is signed between the prospective shipowner and the ship builder. This date and the construction number (i.e. hull numbers) of all the vessels included in the contract are to be declared by the party applying for the assignment of class to a newbuilding. The date of 'contract for construction' of a series of sister ships, including specified optional ships for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective shipowner and the ship builder. In this section a 'series of sister ships' is a series of ships built to the same approved plans for classification purposes, under a single contract for construction. The optional ships will be considered part of the same series of sister ships if the option is exercised not later than 1 year after the contract to build the series was signed. If a contract for construction is later amended to include additional ships or additional options, the date of 'contract for construction' for such ships is the date on which the amendment to the contract is signed between the prospective shipowner and the ship builder. The amendment to the contract is to be considered as a 'new contract'. If a contract for construction is amended to change the ship type, the date of 'contract for construction' of this modified vessel, or vessels, is the date on which the revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder. Where it is desired to use existing approved ship or machinery plans for a new contract, written application is to be made to LR. Sister ships may have minor design alterations provided that such alterations do not affect matters related to classification, or if the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the ship builder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to LR for approval.
  - (c) All reports of survey are to be made by surveyors authorised by members of the LR Group to survey and report (hereinafter referred to as 'the Surveyors') according to the form prescribed, and submitted for the consideration of the Classification Committee.
  - (d) Information contained in the reports of classification and statutory surveys will be made available to the relevant owner, National Administration, Port State Administration, P&I Club, hull underwriter and, if authorised in writing by that owner, to any other person or organisation.
  - (e) Notwithstanding the general duty of confidentiality owed by LR to its client in accordance with the LR Rules, LR clients hereby accept that, LR will participate in the IACS Early Warning System which requires each IACS member to provide its fellow IACS members and Associates with relevant technical information on serious hull structural and engineering systems failures, as defined in the IACS Early Warning System (but not including any drawings relating to the ship which may be the specific property of another party), to enable such useful information to be shared and utilised to facilitate the proper working of the IACS Early Warning System. LR will provide its client with written details of such information upon sending the same to IACS Members and Associates.
  - (f) Information relating to the status of classification and statutory surveys and suspensions/withdrawals of class together with any associated conditions of class will be made available as required by applicable legislation or court order.
  - (g) A Classification Executive consisting of senior members of LR's Classification Department staff shall carry out whatever duties that may be within the function of the Classification Committee that the Classification Committee assigns to it.
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## ■ Section 6

### Ethics

6.1 No LR Group employee is permitted under any circumstances, to accept, directly or indirectly, from any person, firm or company, with whom the work of the employee brings the employee into contact, any present, bonus, entertainment or honorarium of any sort whatsoever which is of more than nominal value or which might be construed to exceed customary courtesy extended in accordance with accepted ethical business standards.

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**■** *Section 7***Non-Payment of Fees**

7.1 LR has the power to withhold or, if already granted, to suspend or withdraw any ship from class (or to withhold any certificate or report in any other case), in the event of non-payment of any fee to any member of the LR Group.

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**■** *Section 8***Limits of Liability**

8.1 When providing services LR does not assess compliance with any standard other than the applicable LR Rules, international conventions and other standards agreed in writing.

8.2 In providing services, information or advice, LR does not warrant the accuracy of any information or advice supplied. Except as set out herein, LR will not be liable for any loss, damage or expense sustained by any person and caused by any act, omission, error, negligence or strict liability of LR or caused by any inaccuracy in any information or advice given in any way by or on behalf of LR even if held to amount to a breach of warranty. Nevertheless, if the Client uses LR services or relies on any information or advice given by or on behalf of LR and as a result suffers loss, damage or expense that is proved to have been caused by any negligent act, omission or error of LR or any negligent inaccuracy in information or advice given by or on behalf of LR then LR will pay compensation to the client for its proved loss up to but not exceeding the amount of the fee (if any) charged for that particular service, information or advice.

8.3 LR will print on all certificates and reports the following notice: Lloyd's Register Group Limited, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as 'Lloyd's Register'. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

8.4 Except in the circumstances of section 8.2 above, LR will not be liable for any loss of profit, loss of contract, loss of use or any indirect or consequential loss, damage or expense sustained by any person caused by any act, omission or error or caused by any inaccuracy in any information or advice given in any way by or on behalf of LR even if held to amount to a breach of warranty.

8.5 Any dispute about LR services is subject to the exclusive jurisdiction of the English courts and will be governed by English law.

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# Classification Regulations

## Chapter 2

### Section 1

#### Section

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- 2 **Surveys - General**
- 3 **IACS QSCS and other audits**

### ■ Section 1 Conditions for classification

#### 1.1 General

1.1.1 The requirements of these Regulations apply to ships which operate principally within the limits of the Great Lakes and the River St. Lawrence, with the seaward limit, as a straight line drawn from Cap des Rosiers on the Gaspé Peninsula to the west point of Anticosti Island and from Anticosti Island to the north shore of the River St. Lawrence along the meridian of longitude sixty-three degrees west.

1.1.2 It is required that ships classed in accordance with these Regulations will be laid up in fresh water each winter at a River St. Lawrence or a Great Lakes port.

1.1.3 Ships intended to be employed on the Great Lakes and River St. Lawrence and built in accordance with LR's *Rules and Regulations for the Classification of Ships for Service on the Great Lakes and River St. Lawrence* or with alternative arrangements equivalent thereto, will be assigned a class in the *Register Book* and will continue to be classed so long as they are found upon examination at the prescribed surveys to be maintained in accordance with the requirements of these Regulations. Classification will be conditional upon compliance with LR's requirements for both hull and machinery.

1.1.4 Except where stated otherwise by these Rules and Regulations, the relevant requirements of LR's *Rules and Regulations for the Classification of Ships* (hereinafter referred to as the Rules for Ships) will apply.

1.1.5 Any damage, defect, breakdown or grounding which could invalidate the conditions for which a class has been assigned is to be reported to LR without delay.

1.1.6 The Rules for Ships are based on the understanding that ships will be properly loaded and handled. They do not, unless stated in the class notation, provide for special distribution or concentration of loading. The Committee may also require additional strengthening to be fitted in any ship which in their opinion may be subjected to severe stresses due to particular features in the design or when it is desired to make provision for exceptional loaded or ballasted conditions. In these cases particulars are to be submitted for consideration.

#### 1.2 Character of classification and class notation

1.2.1 **Class 100A1 with special service notation.** This class will be assigned to ships intended to operate on the Great Lakes and River St. Lawrence, and built in accordance with the Rules for Ships. The class notation affixed to the character in the *Register Book* will indicate the particular service for which the ship is approved. The geographical and where applicable, seasonal limits of the service will be defined.

1.2.2 **Class A1 (For restricted service).** This class will be assigned to ships intended to trade only within specially sheltered waters, such as harbours or rivers within the limits as defined in Ch 2, 1.1 General, provided the scantlings, arrangements and equipment are approved by the Committee as suitable for such service. The class notation affixed to the character will indicate the geographical limits for which the ship has been approved.

1.2.3 The notation **Winters in the Great Lakes** may be assigned to the class of a ship, in order to permit five year docking survey intervals, when it has been requested and confirmed by the Owner and agreed by the Committee, that the ship will lay up each winter in fresh water, in a River St. Lawrence or a Great Lakes port.

#### 1.3 Materials

1.3.1 The materials used in the repair of hull and machinery are to be manufactured, tested and inspected in accordance with the requirements of Part 2 of the Rules for Ships. The steel is to be manufactured by an approved process at works recognized by the Committee. Alternatively, tests to the satisfaction of the Committee will be required to demonstrate the suitability of the steel.

# Classification Regulations

## Chapter 2

### Section 2

## ■ Section 2 Surveys - General

### 2.1 Statutory surveys

2.1.1 LR is authorized by the Government of Canada to assign Load Lines to ships, in accordance with the requirements of the *'Consolidated Regulations to the Canada Shipping Act'*.

2.1.2 LR is authorized by the Government of Canada to carry out surveys or inspections in accordance with the *'2000 Delegated Statutory Inspection Program'* and with *'The Classed Ship Inspection Regulations, 1988, of the Consolidated Regulations to the Canada Shipping Act'*.

### 2.2 Existing ships

2.2.1 **Classification of ships not built under survey.** The requirements of the Committee for the classification of ships which have not been built under LR's survey are indicated in Pt 1, Ch 3, 19 Classification of ships not built under survey of the Rules for Ships. Special consideration will be given to ships transferring class to LR from another recognized Society.

2.2.2 **Reclassification.** The requirements of Pt 1, Ch 2, 3.3 Existing ships of the Rules for Ships are to be complied with.

### 2.3 Damages, repairs and alterations

2.3.1 All repairs to hull, equipment and machinery which may be required in order that a ship may retain class, see Ch 2, 1.1 General, are to be carried out to the satisfaction of the LR Surveyors. When damages are sustained or where repairs are effected at a port or location where the services of an LR Surveyor are not available, LR is to be advised as soon as possible and the repairs are to be surveyed by LR at the earliest opportunity thereafter.

2.3.2 When at any survey the Surveyors consider repairs to be immediately necessary, either as a result of damage, or wear and tear, they are to communicate their recommendations at once to the Owner or his representative. When such recommendations are not complied with, immediate notification is to be given to the Committee by the Surveyors.

2.3.3 When at any survey it is found that any damage, defect or breakdown (see Ch 2, 1.1 General) is of such a nature that does not require immediate permanent repair, but is sufficiently serious to require rectification by a prescribed date in order to maintain class, a suitable condition of class is to be imposed by the Surveyors and recommended to the Committee for consideration.

2.3.4 If a ship which is classed with LR is to leave harbour limits or protected waters under tow, the Owner is to advise LR of the circumstances prior to her departure.

2.3.5 If a ship which is classed with LR is taken in tow whilst at sea, the Owner is to advise LR of the circumstances at the first practicable opportunity.

2.3.6 Plans and particulars of any proposed alterations to the approved scantlings and arrangements of hull, equipment, or machinery are to be submitted for approval, and such alterations are to be carried out to the satisfaction of LR's Surveyors.

### 2.4 Existing ships - Periodical Surveys

2.4.1 Annual Surveys are to be held on all ships within three months, before or after each anniversary of the completion, commissioning or Special Survey in accordance with the requirements given in Ch 3, 2 Annual Surveys – Hull and machinery requirements.

2.4.2 Intermediate Surveys are to be held on all ships after the third Special Survey in accordance with the requirements of Ch 3, 3 Intermediate Surveys – Hull and machinery requirements. This survey may be held instead of the second or third Annual Survey.

2.4.3 The Owner should notify LR whenever a ship can be examined in dry-dock. Docking Surveys are to be carried out at intervals not exceeding five years in accordance with the requirements of Ch 3, 4 Docking Surveys – Hull and machinery requirements. Consideration may be given at the discretion of the Committee to any special circumstances justifying an extension of this interval. Before an extension can be agreed, a survey afloat of the underwater parts may be required at the discretion of the Committee.

2.4.4 A Hull Special Survey, is to be carried out on all ships at an interval not exceeding five years from the anniversary of the date of build or the previous Hull Special Survey, in accordance with the requirements of Ch 3, 5 Hull Special Survey – Hull requirements.

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## Chapter 2

### Section 2

2.4.5 Postponement of the Hull Special Survey may be permitted by the Committee either completely or in part for a maximum period of 12 months, provided, by the due date:

- (a) For complete postponement, a general examination of the ship including the requirements of an Annual Survey and an examination of at least the forward and aft side ballast tanks (port and starboard) is carried out to the Surveyor's satisfaction. An underwater examination may be required at the discretion of the Committee.
- (b) For partial postponement, the items outstanding for completion of Hull Special Survey are generally examined to confirm satisfactory condition to the Surveyor's satisfaction.
- (c) That thickness measurements are completed as far as practicable to the Surveyor's satisfaction.

On completion of the Hull Special Survey, the assigned date will be the last date the vessel was in dry dock for Special Survey or the Special Survey due date whichever is the later. The date assigned is not to exceed six years from the previous due date.

2.4.6 An Engine Special Survey is to be carried out on all ships as required by Pt 1, Ch 2, 3.5 Existing ships – Periodical Surveys of the Rules for Ships.

2.4.7 At the request of the Owner, and with the agreement of the Committee, the complete survey of the hull or the machinery may be carried out on a Continuous Survey basis. All compartments of the hull are to be opened for survey and testing of the various items of machinery, in rotation with an interval of five years between consecutive examinations of each part. In general, approximately 20 per cent of hull or machinery items is to be examined each year.

2.4.8 The CSM or ES date may be postponed for up to one year and will be assigned to harmonize with the Hull Special Survey date.

2.4.9 Machinery is to be surveyed as indicated in Pt 1, Ch 3, 11 Machinery surveys - General requirements of the Rules for Ships.

## 2.5 Certificates

2.5.1 The requirements of Pt 1, Ch 2, 3.7 Certificates Pt 1, Ch 2, 3.7 Certificates and Pt 1, Ch 2, 3.7 Certificates of the Rules for Ships, are to be complied with as applicable.

## 2.6 Notice of surveys

2.6.1 It is the responsibility of the Owner to ensure that all surveys necessary for the maintenance of class are carried out at the proper time and in accordance with the instructions of the Committee.

2.6.2 LR will give timely notice to an Owner about forthcoming surveys by means of computer access to class records via Class Direct. The omission of such a notice, however, does not absolve the Owner from his responsibility to comply with LR's survey requirements for maintenance of class.

## 2.7 Withdrawal/Suspension of class

2.7.1 When the class of a ship, for which the Regulations as regards surveys on hull, equipment and machinery have been complied with, is withdrawn by the Committee in consequence of a request from the Owner, the notation 'Class withdrawn at Owner's request' (with date) will be assigned.

2.7.2 When the Regulations as regards surveys on the hull, equipment or machinery have not been complied with and the ship is thereby not entitled to retain class, the class will be suspended or withdrawn, at the discretion of the Committee, and a corresponding notation will be assigned.

2.7.3 Class will be automatically suspended if the Annual Survey or the Intermediate Survey is not completed within three months of the due date of the survey.

2.7.4 Class will be automatically suspended in the event that the Special Survey has not been completed by the due date and an extension has not been agreed, or is not under attendance by the Surveyors with a view to completion prior to resumption of trading.

2.7.5 When in accordance with Ch 2, 2.3 Damages, repairs and alterations a condition of class is imposed, this will be assigned a due date for completion and the ship's class will be subject to suspension procedure if the condition of class is not dealt with, or postponed by agreement by the due date.

2.7.6 When it is found from the reported condition of the hull or equipment or machinery of a ship, that an Owner has failed to comply with Ch 2, 1.1 General, Ch 2, 2.3 Damages, repairs and alterations and Ch 2, 2.3 Damages, repairs and alterations, the class will be liable to be suspended or withdrawn at the discretion of the Committee and a corresponding notation assigned.

# Classification Regulations

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### Section 3

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2.7.7 The remaining requirements of Pt 1, Ch 2, 3.9 Withdrawal/Suspension of class Pt 1, Ch 2, 3.9 Withdrawal/Suspension of class, Pt 1, Ch 2, 3.9 Withdrawal/Suspension of class and Pt 1, Ch 2, 3.9 Withdrawal/Suspension of class, of the Rules for Ships will be applied as considered necessary.

#### **2.8 Laid-up ships**

2.8.1 At the request of an Owner, ships which are laid-up after having spent a period of time in service may be maintained in class without survey until the due date of the Hull Special Survey.

2.8.2 If the ship remains laid-up beyond the due date of the Special Survey, the notation 'Laid-up Surveys Overdue' will be assigned.

2.8.3 After a further 24 months, the Committee's agreement to maintain the 'Laid-up Surveys Overdue' notation will be required.

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### ■ Section 3 IACS QSCS and other audits

#### **3.1 Audit of surveys**

3.1.1 The surveys required by the Regulations may be subject to audit in accordance with the requirements of the International Association of Classification Societies Quality System Certification Scheme and by the National Authority.

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# Periodical Survey Regulations

## Chapter 3

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- 6 **Machinery Surveys**
- 7 **Classification of ships not built under survey**

### ■ Section 1 General

#### 1.1 Frequency of surveys

1.1.1 The requirements of this Chapter are applicable to the Periodical Surveys set out in Ch 2, 2.4 Existing ships - Periodical Surveys. Except as amended at the discretion of the Committee, the periods between such surveys are as follows:

- (a) Annual Surveys as required by Ch 2, 2.4 Existing ships - Periodical Surveys.
- (b) Intermediate Surveys as required by Ch 2, 2.4 Existing ships - Periodical Surveys.
- (c) Docking Surveys as required by Ch 2, 2.4 Existing ships - Periodical Surveys.
- (d) Special Surveys (Lakes) at five yearly intervals as required by Ch 2, 2.4 Existing ships - Periodical Surveys.
- (e) Complete survey of machinery at five yearly intervals as required by Pt 1, Ch 2, 3.5 Existing ships – Periodical Surveys of the Rules for Ships.

1.1.2 For the frequency of surveys of boilers, steam pipes, screwshafts, tube shafts, propellers and inert gas systems, see Pt 1, Ch 3, 15 Boilers of the Rules for Ships.

#### 1.2 Surveys for damage or alterations

1.2.1 At any time when a ship is undergoing alterations, or damage repairs, any exposed parts of the structure normally difficult to access are to be specially examined, e.g. if any part of the main or auxiliary machinery, including boilers, insulation or fittings, is removed for any reason, the steel structure in way is to be carefully examined by the Surveyor, or when cement in the bottom or covering on decks is removed the plating in way is to be examined before the covering is relaid.

#### 1.3 Unscheduled surveys

1.3.1 In the event that LR has cause to believe that its Regulations are not being complied with, LR reserves the right to perform unscheduled surveys of the hull or machinery.

#### 1.4 Definitions

1.4.1 As prescribed in Pt 1, Ch 3, 1.5 Definitions of the Rules for Ships and as noted below.

1.4.2 A **Great Lakes Bulk Carrier** is a ship which is constructed generally with a single deck, side tanks and double bottom tanks in way of the cargo holds, and is intended to carry dry cargo in bulk.

1.4.3 A **Ballast Tank** is a tank which is used to carry salt and/or fresh water ballast.

1.4.4 A **Transverse Section** includes all longitudinal members such as plating, longitudinals and girders at the deck, side, bottom, longitudinal bulkhead, tunnel deck and inner bottom.

1.4.5 **Laid-Up.** A ship may be regarded as laid-up when it is taken out of service for a period of time.

# Periodical Survey Regulations

## Chapter 3

### Section 2

#### ■ Section 2

### Annual Surveys – Hull and machinery requirements

#### 2.1 General

2.1.1 Annual Surveys are to be held concurrently with statutory annual surveys or other relevant statutory surveys, wherever practicable.

2.1.2 At Annual Surveys, the Surveyor is to examine the ship and machinery, so far as necessary and practicable, in order to satisfy him/herself as to their general condition.

2.1.3 When carrying out an Annual Survey, the Surveyor must confirm that the ship is in possession of a valid Inspection Certificate issued by Transport Canada.

#### 2.2 Annual Survey

2.2.1 The requirements of Pt 1, Ch 3, 2.2 Annual Surveys of the Rules for Ships, so far as applicable, are to be complied with. However, the requirement for cargo hold examinations may be excluded.

2.2.2 For Self-Unloading Bulk Carriers, the tunnel spaces below the cargo holds should be examined.

2.2.3 When, at the request of an Owner, and when authorized by the Government of Canada, an Annual Survey or Inspection, as required by the Classed Ship Inspection Regulations, 1988, may be carried out in accordance with the Schedule to the Regulations.

#### ■ Section 3

### Intermediate Surveys – Hull and machinery requirements

#### 3.1 General

3.1.1 Intermediate Surveys are to be held concurrently with statutory Annual Surveys and/or other relevant statutory surveys wherever practicable. The tank examination can be progressed at any time between the second and third annual survey.

3.1.2 At Intermediate Surveys, the Surveyor is to examine the ship and machinery, so far as necessary and practicable, to satisfy him/herself as to their general condition.

3.1.3 When carrying out an Intermediate Survey, the Surveyor must confirm that the ship is in possession of a valid Inspection Certificate issued by Transport Canada.

#### 3.2 Intermediate Survey

3.2.1 The requirements of Ch 3, 2.2 Annual Survey are to be complied with, so far as applicable.

3.2.2 All side water ballast tanks are to be generally examined and tested (see Ch 3, 5.3 Examination and testing) unless epoxy coated or equivalent. This examination may be extended to include close-up survey and thickness measurement, as considered necessary by the Surveyor.

#### ■ Section 4

### Docking Surveys – Hull and machinery requirements

#### 4.1 General

4.1.1 At Docking Surveys, the Surveyor is to examine the ship and machinery, so far as necessary and practicable, in order to be satisfied as to the general condition.

#### 4.2 Docking Survey

4.2.1 The requirements of Pt 1, Ch 3, 4.2 Docking Surveys of the Rules for Ships, are to be complied with, so far as applicable.

# Periodical Survey Regulations

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4.2.2 Attention is to be given to parts of the structure (i.e. shell plating and rubbing bars) particularly liable to chafing and contact and to any undue fairness of the side or bottom plating. Where damage is noted, an internal examination of the damaged area may be required, as considered necessary by the Surveyor.

## ■ Section 5 Hull Special Survey – Hull requirements

### 5.1 General

5.1.1 The Hull Special Survey is to be of sufficient extent to ensure that the hull is in a satisfactory condition and is fit for its intended purpose, subject to proper maintenance and operation and to periodical surveys being carried out as required by the Regulations.

5.1.2 The requirements of Ch 3, 2 Annual Surveys – Hull and machinery requirements for Annual Surveys, are to be complied with for all ships, as applicable.

### 5.2 Preparation

5.2.1 The ship is to be prepared for overall survey. The preparation should be of sufficient extent to facilitate an examination to ascertain the extent of any excessive corrosion, deformation, fractures, damages and other structural deterioration.

5.2.2 The holds, tunnels, peak tanks, side and double bottom ballast tanks, engine and boiler spaces and other spaces are to be cleared and cleaned as necessary and prepared for examination. Platform plates in the engine and boiler spaces are to be lifted as may be necessary for the examination of the structure below. Where necessary, close and spar ceiling, lining and pipe casings are to be removed for examination of the structure.

5.2.3 The steelwork is to be exposed and cleaned, and rust removed as may be required for its proper examination by the Surveyor.

5.2.4 All tanks are to be cleaned as necessary to permit examination, where this is required.

5.2.5 The chain locker is to be cleaned internally and the anchors and chain cables (including stern anchor and chain cable where applicable, see 5.2.6) cleaned and ranged or placed in an accessible position for inspection. If any length of chain cable is found to be reduced in mean diameter at its most worn part by 12 per cent or more from its nominal diameter, it is to be renewed. The windlass is to be examined.

5.2.6 For those ships with a special service notation which includes areas off the East Coast of Canada, the stern anchor and chain cables are to be examined as required by 5.2.5.

5.2.7 Where on self-unloading bulk carriers, plastic sheathing is fitted to the hopper plating, selected areas of sheathing are to be removed for examination of the plating beneath as considered necessary by the Surveyor, see also Ch 3, 1.2 Surveys for damage or alterations.

5.2.8 Tanks (excluding peak tanks) used exclusively for fuel oil, domestic fresh water or lubricating oil, need not be examined internally provided that the Surveyor is satisfied with the condition, after both external examination and test. Where the boundary of the tank is common with the side shell structure, an internal examination may be required by the Surveyor.

### 5.3 Examination and testing

5.3.1 All spaces within the hull and superstructure are to be examined.

5.3.2 All tanks are to be tested by a head sufficient to give the maximum pressure that can be experienced in service. Tanks may be tested afloat provided that their internal examination is also carried out afloat.

5.3.3 Where repairs are effected to the shell plating or bulkheads, any tanks in way are to be tested to the Surveyor's satisfaction on completion of such repairs.

5.3.4 In cases where the inner surface of the bottom plating is covered with cement, asphalt, or other composition, the removal of this covering may be dispensed with, provided that it is inspected, tested by beating or chipping and found sound and adhering satisfactorily to the steel.

5.3.5 All decks, casings, superstructures and hatch covers are to be examined.

# Periodical Survey Regulations

## Chapter 3

### Section 5

5.3.6 Mechanically operated hatch covers are to be tested to confirm satisfactory operation including stowage, the effectiveness of sealing arrangements and operational testing of power components, wires and chains.

5.3.7 The masts and standing rigging are to be examined.

5.3.8 The hand pumps, suction and watertight doors are to be examined and tested as necessary.

5.3.9 The Surveyor is to be satisfied as to the efficient condition and operation of the helm indicator and protection of aft steering wheel and gear.

#### 5.4 Thickness measurement

5.4.1 The Surveyor may require to measure the thickness of the material in any portion of the structure where signs of wastage are evident or wastage is normally found. Any parts of the structure which are found defective or excessively reduced in scantlings are to be made good by materials of the approved scantlings and quality. The minimum requirements for thickness measurements are given in Table 3.5.1 Thickness Measurements - Lakers.

**Table 3.5.1: Thickness Measurements - Lakers**

At the fourth Special Survey (i.e. ships about 20 years old) the minimum requirements for thickness measurement are as follows:	At the fifth Special Survey (i.e. ships about 25 years old) the minimum requirements for thickness measurement are as follows:	At the sixth Special Survey and subsequently (i.e. ships about 30 years old and over) the minimum requirements for thickness measurement are as follows:
One transverse section at midships outside line of cargo hatch openings.	Two transverse sections, outside line of cargo hatch openings within 0,6L amidships.	Three transverse sections, outside line of cargo hatch openings, within 0,6L amidships.
Representative measurements of shell frames and longitudinal bulkhead vertical stiffeners, between each stringer, and cargo hold arch webs, in way of the transverse sections in (a) as considered necessary by the attending Surveyor.		
All transverse watertight bulkheads in all side tanks within the cargo hold length.		
Selected cargo hold hatch covers (top plating and internal stiffeners).		
Critical areas as required by the Surveyor.		

5.4.2 For those areas of plates and stiffeners where diminution levels are found to be approaching the allowable margins as defined in Table 3.5.2 Maximum permissible diminution levels of individual plates and stiffeners, further measurement may be required at Annual and Intermediate Surveys to confirm the continued satisfactory condition of the structure.

**Table 3.5.2: Maximum permissible diminution levels of individual plates and stiffeners**

Structural item	Maximum diminution
<b>Hull envelope:</b> individual plates, shell and deck plating recorded along the strake (deck, bottom, side)	30%
<b>Longitudinal structural members</b> (including deck and shell longitudinal stiffeners, longitudinal bulkhead)	30%
<b>Transverse structural members W.B. Tanks</b>	30%
<b>W.T. transverse bulkheads</b>	30%
<b>Miscellaneous structural members</b> (including deck plating inside the line of cargo hatch openings)	30%

5.4.3 Thickness measurements are to be taken at the forward and aft areas of all plates. The measurements are to represent the average of the multiple measurements taken on each plate and/or stiffener. Where measured plates are required to be renewed, the thicknesses of adjacent plates in the same strake are to be measured.

5.4.4 Thickness measurements are normally to be taken by means of ultrasonic test equipment and are to be carried out by a firm approved in accordance with LR's Approval for Thickness Measurement of Hull Structures.

# Periodical Survey Regulations

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- 5.4.5 The work of approved firms is subject to check testing by the Surveyor.
- 5.4.6 Thickness measurements may be carried out in association with the fourth Annual Survey.
- 5.4.7 The Surveyor may extend the scope of thickness measurement, if deemed necessary.
- 5.4.8 Where substantial corrosion is identified and not rectified, this will be subject to re-examination and gauging as necessary at Annual and Intermediate Surveys.
- 5.4.9 At each Special Survey, thickness measurements are to be taken in way of critical areas, as considered necessary by the Surveyor. Critical areas are to include locations throughout the ship that show substantial corrosion and/or are considered prone to rapid wastage.

### 5.5 Thickness measurement reporting

5.5.1 A report is to be prepared by the approved firm carrying out the thickness measurement. The report is to give the location of measurement, the thickness measured as well as the corresponding original thickness. The report is to give the date when the measurement was carried out, the type of measuring equipment, names of personnel and their qualifications, and is to be signed by the Operator.

5.5.2 The thickness measurement report is to be verified and signed by the Surveyor.

**Table 3.5.3: Maximum diminution of topsides and bottom area**

	Structural Item	Over 0,5L midships	At 0,075L from ends	TM Report Form
Topside area assessment as reported on TM 2(a) and TM 3	Plating	15%	30%	TM8
	Longitudinals	25%	30%	
Structural item	Plating – single bottom const.	15%	30%	TM8
Bottom area assessment as reported on TM 2(a) and TM 3	Plating — double bottom const.	20%	30%	
	Longitudinals	20%	30%	
<b>Note</b> 1. Intermediate values are to be obtained by linear interpolation.				
<b>Note</b> 2. Topsides area comprises deck (outside line of openings for dry cargo ships), stringer and sheer strake (including rounded gunwales) together with associated longitudinals.				
<b>Note</b> 3. Bottom area comprises keel, bottom and bilge plating together with associated longitudinals.				

## Section 6

### Machinery Surveys

#### 6.1 General

6.1.1 For the surveys of machinery including turbines, steam engines, oil engines, electrical equipment, boilers, steam pipes, screwshafts and propellers, etc. the requirements of Pt 1, Ch 3, 11 Machinery surveys - General requirements of the Rules for Ships are to be complied with as applicable.

#### 6.2 Modified Screwshaft Survey

6.2.1 A Modified Survey may be accepted at alternate five-yearly surveys for shafts described in Pt 1, Ch 3, 17.1 Frequency of surveys of the Rules for Ships, provided they are fitted with oil lubricated bearings and approved oil glands and also for those in Pt 1, Ch 3, 17.1 Frequency of surveys and Pt 1, Ch 3, 17.1 Frequency of surveys provided that:

- The oil glands have split seals which can be removed/renewed in dry-dock without withdrawing the shaft.
- In-service sterntube lubricating oil temperature monitoring has been arranged and is recorded.

# Periodical Survey Regulations

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### Section 7

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- (c) Sterntube lubricating oil analysis is taken at regular intervals not exceeding six months and the results are presented to the Surveyors at each annual survey.
  - (d) Sterntube lubricating oil consumption is recorded.
  - (e) Facilities are provided for measurement of bearing wear.

6.2.2 The Modified Survey, for keyless propellers or shafts with a solid flange connection to the propeller, is to consist of a visual examination to confirm the good condition of the sealing arrangements. All accessible parts of the screwshaft are to be examined by magnetic particle inspection methods so far as is practicable. Wear is to be measured and found satisfactory. Where a controllable pitch propeller is fitted, at least one of the blades is to be dismantled completely for examination of the working parts and the controlgear.

6.2.3 For keyed propellers, the aft end of the cylindrical shaft and forward one third of the shaft cone is to be examined by a magnetic particle crack detection method, for which dismantling of the propeller and removal of the key is required.

6.2.4 All the data is to be found within permissible limits. Where any doubt exists regarding any of the above findings, the shaft is to be withdrawn to permit an entire examination.

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## ■ Section 7

### Classification of ships not built under survey

#### 7.1 General

7.1.1 When classification is desired for a ship not built under the supervision of LR's Surveyors, application should be made to the Committee in writing.

7.1.2 Periodical Surveys of such ships, when classed, are subsequently to be held as in the case of ships built under survey.

7.1.3 Where classification is desired for a ship which is classed by another recognized Society, special consideration will be given to the scope of the survey.

#### 7.2 Hull, equipment and machinery

7.2.1 The requirements of Pt 1, Ch 3, 19.2 Hull and equipment and Pt 1, Ch 3, 19.3 Machinery of the Rules for Ships are to be complied with as applicable.

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CHAPTER	1	GENERAL REGULATIONS
CHAPTER	2	CLASSIFICATION REGULATIONS
CHAPTER	3	PERIODICAL SURVEY REGULATIONS
<b>CHAPTER</b>	<b>4</b>	<b>SHIP STRUCTURES</b>
		<b>SECTION 1 GENERAL</b>
		<b>SECTION 2 MATERIALS</b>
		<b>SECTION 3 LONGITUDINAL STRENGTH</b>
		<b>SECTION 4 DECK STRUCTURE</b>
		<b>SECTION 5 SHELL ENVELOPE PLATING</b>
		<b>SECTION 6 SHELL ENVELOPE FRAMING</b>
		<b>SECTION 7 WING TANK STRUCTURE</b>
		<b>SECTION 8 DOUBLE BOTTOM STRUCTURE</b>
		<b>SECTION 9 BULKHEADS</b>
		<b>SECTION 10 FORE PEAK STRUCTURE</b>
		<b>SECTION 11 SUPERSTRUCTURES, DECKHOUSES AND MACHINERY SPACE OPENINGS</b>
		<b>SECTION 12 CLOSING ARRANGEMENTS FOR DECK AND SHELL</b>
		<b>SECTION 13 VENTILATORS, AIR PIPES AND DISCHARGES</b>
		<b>SECTION 14 EQUIPMENT</b>

# Ship Structures

## Chapter 4

### Section 1

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#### Section

- 1 **General**
  - 2 **Materials**
  - 3 **Longitudinal strength**
  - 4 **Deck structure**
  - 5 **Shell envelope plating**
  - 6 **Shell envelope framing**
  - 7 **Wing tank structure**
  - 8 **Double bottom structure**
  - 9 **Bulkheads**
  - 10 **Fore peak structure**
  - 11 **Superstructures, deckhouses and machinery space openings**
  - 12 **Closing arrangements for deck and shell**
  - 13 **Ventilators, air pipes and discharges**
  - 14 **Equipment**
- 

#### ■ Section 1 General

##### 1.1 Application

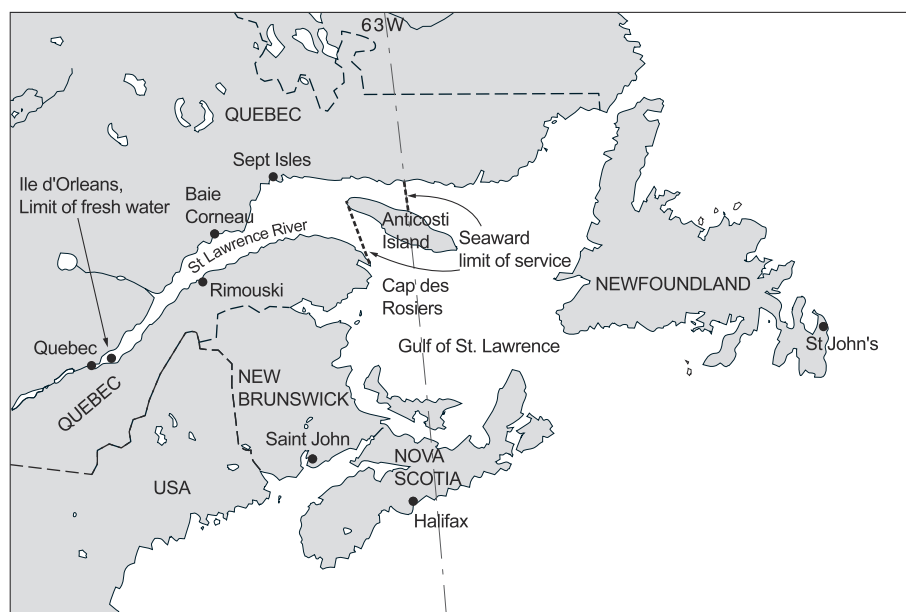
1.1.1 These Rules apply to ships which intend to operate within the limits of the Great Lakes and the River St. Lawrence, with the seaward limit, as a straight line drawn from Cap des Rosiers on the Gaspé Peninsula to the west point of Anticosti Island and from Anticosti Island to the north shore of the River St. Lawrence along the meridian of longitude sixty-three degrees west. See Figure 4.1.1 Sketch of the map of the Gulf of St. Lawrence and River St. Lawrence showing the seaward and fresh water limits of service.



# Ship Structures

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### Section 1



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**Figure 4.1.1: Sketch of the map of the Gulf of St. Lawrence and River St. Lawrence showing the seaward and fresh water limits of service**

1.1.2 Except as indicated in these Rules, the relevant requirements of Pt 3 Ship Structures (General) and Pt 4 Ship Structures (Ship Types) of LR's *Rules and Regulations for the Classification of Ships* (hereinafter referred to as the Rules for Ships) will apply.

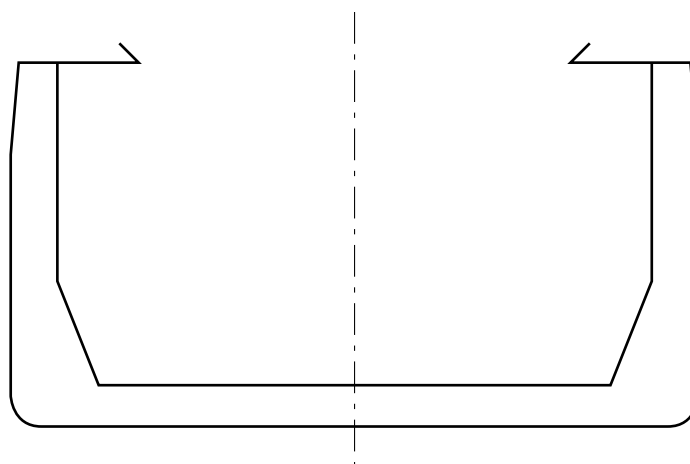
1.1.3 In addition to cases where direct calculation methods are specifically required by the Rules, LR will consider alternative arrangements and scantlings which have been derived by direct calculations in lieu of specific Rule requirements. All direct calculations are to be submitted for examination.

1.1.4 For the application of these Rules under Canadian registration, the ship requires to have load lines assigned in accordance with the requirements of the Canada Shipping Act Load Line Regulations (Inland).

1.1.5 The joint requirements, required for a ship to transit the St. Lawrence Seaway between Montreal and Lake Ontario and between Lake Ontario and Lake Erie are given in the publication "The Seaway Handbook", details of which can be found on the web page: <http://www.greatlakes-seaway.com>

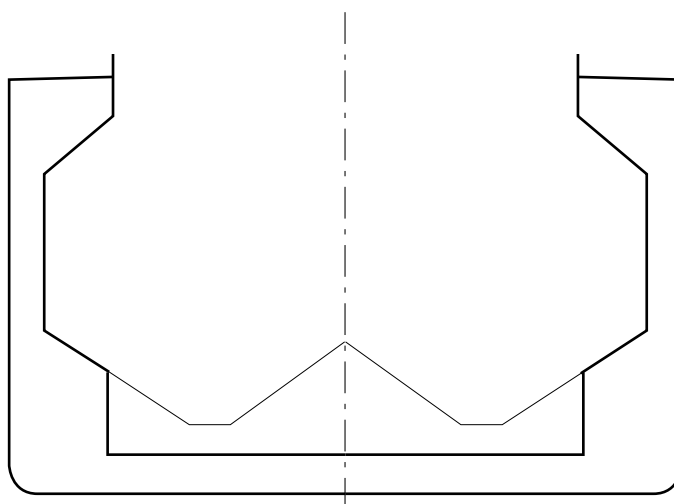
## 1.2 Structural configuration

1.2.1 These Rules will apply to single deck ships, of steel, welded construction, with or without self-unloading equipment, with side wing tanks and a double bottom throughout the cargo region, designed for the carriage of bulk dry cargoes. Machinery compartment will be arranged aft with accommodation arranged forward or aft. However, consideration will be given to other arrangements on the basis of the requirements of these Rules. See Figure 4.1.2 Typical Great Lakes Bulk Carrier without self-unloading equipment, Figure 4.1.3 Typical Great Lakes Bulk Carrier with self-unloading equipment and Figure 4.1.4 Typical Great Lakes Bulk Carrier with recessed hopper structure with self-unloading equipment.



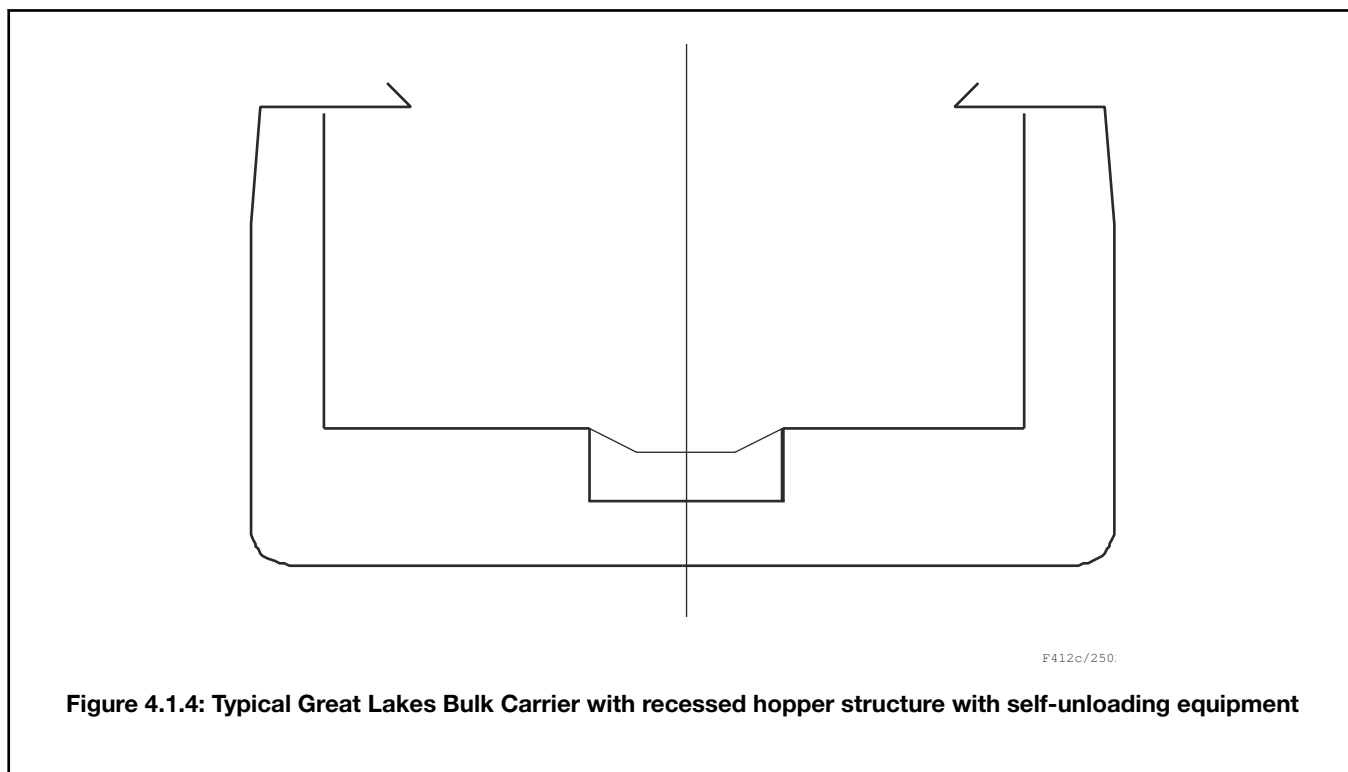
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**Figure 4.1.2: Typical Great Lakes Bulk Carrier without self-unloading equipment**



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**Figure 4.1.3: Typical Great Lakes Bulk Carrier with self-unloading equipment**



1.2.2 Longitudinal framing is to be adopted at the strength deck outside the line of openings and topside area and double bottom in way of the cargo holds.

1.2.3 Transverse or longitudinal framing may be adopted for the side wing tank structure.

1.2.4 Ships complying with these requirements will require to have a collision bulkhead, located as in Ch 4, 9.3 Collision bulkhead, an after peak bulkhead, generally enclosing the sterntube in a watertight compartment and a watertight bulkhead at the forward end of the engine room. Additional bulkheads or equivalent supporting structures are to be arranged in order to provide adequate transverse strength.

### 1.3 Class Notations

1.3.1 In general, ships complying with the requirements of these Rules will be eligible to be classed **100A1 Great Lakes Bulk Carrier** with the specified operating service area notation **for Service on the Great Lakes and River St. Lawrence** and where applicable, with the descriptive note, **Self Unloading** stated in column 6 of the *Register Book*.

1.3.2 Ships intended to be operated only in suitable areas or conditions, which have been agreed by the Committee, as defined in Pt 1, Ch 1, 2 Governance of the Rules for Ships, will receive individual consideration on the basis of the Rules, with respect to the environmental conditions agreed for the design basis and approval.

1.3.3 The Regulations for classification and assignment of class notations are given in Pt 1 Regulations of the Rules for Ships to which reference should be made. The requirements for New Construction Surveys are given in Pt 1, Ch 2, 3.2 New construction surveys of the Rules for Ships.

1.3.4 The notation **IWS** (In-water Survey), according to Pt 1, Ch 2, 2.3 Class notations (hull), of the Rules for Ships, is not applicable.

1.3.5 The notation **ESP** (Enhanced Survey Programme), according to Pt 1, Ch 2, 2.3 Class notations (hull) of the Rules for Ships, is not applicable.

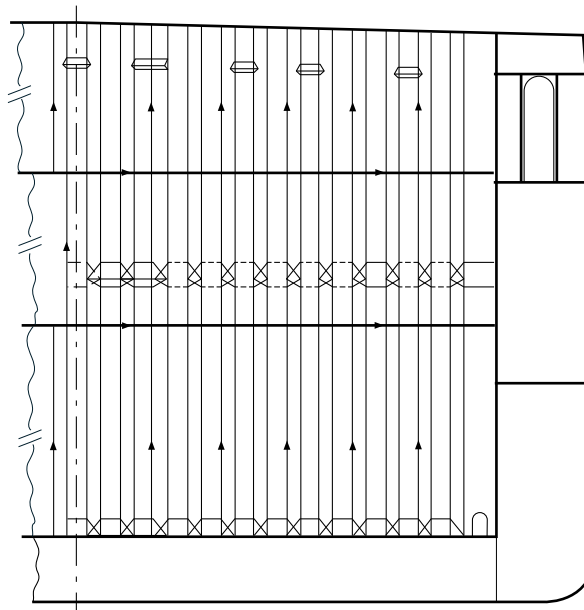
1.3.6 The notation **ESN** (Enhanced Survivability Notation), according to Pt 1, Ch 2, 2.3 Class notations (hull) of the Rules for Ships, is not applicable.

1.3.7 ShipRight notations **SDA**, **FDA** and **CM** are, in general, not applicable.

**1.4 Definitions**

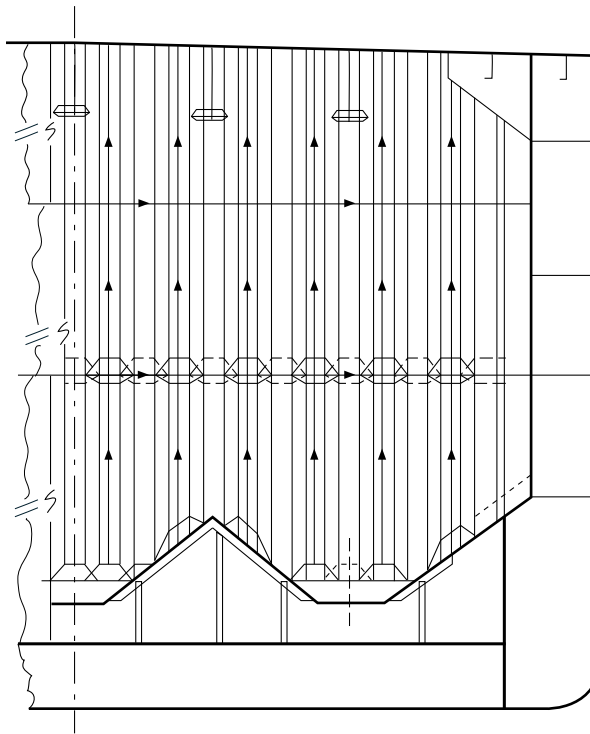
1.4.1 **Principal particulars** are to be taken in accordance with Pt 3, Ch 1, 6.1 Principal particulars of the Rules for Ships, unless specified otherwise in these Rules:

1.4.2 **Screen Bulkhead** is a non-watertight transverse bulkhead between the cargo holds, see Figure 4.1.5 Typical screen bulkhead, with no self-unloading equipment fitted and Figure 4.1.6 Typical screen bulkhead, with self-unloading equipment fitted.



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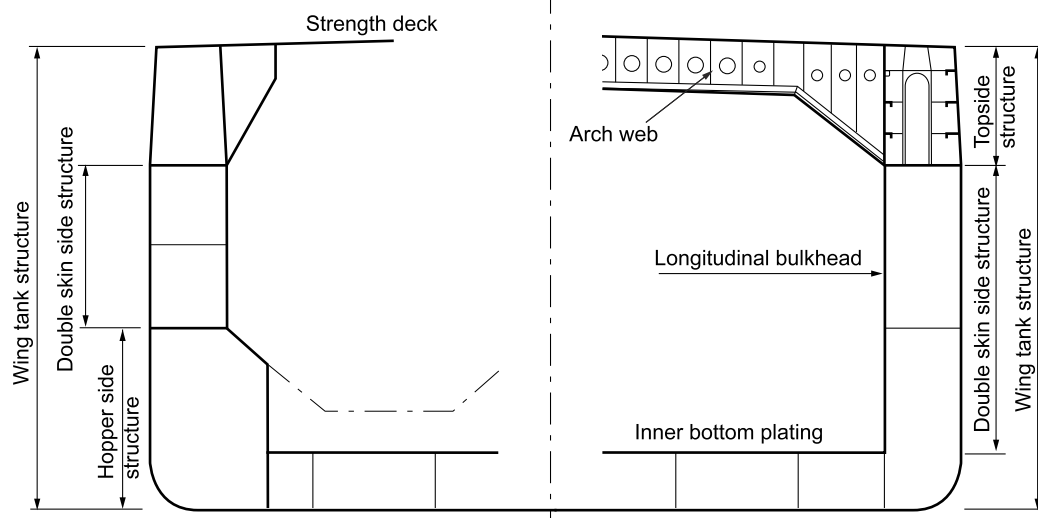
**Figure 4.1.5: Typical screen bulkhead, with no self-unloading equipment fitted**



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**Figure 4.1.6: Typical screen bulkhead, with self-unloading equipment fitted**

1.4.3 **Arch Web** is a strength deck transverse in cargo hold between the cargo hatches, see Figure 4.1.7 Nomenclature.



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**Figure 4.1.7: Nomenclature**

# Ship Structures

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1.4.4 **Strength Deck** is the uppermost continuous weather deck, occasionally referred to as the Upper Deck or Spar Deck, see Figure 4.1.7 Nomenclature.

1.4.5 **Engine Room Gangway Doors.** Side shell port and/or starboard doors in way of the engine room for stores use.

1.4.6 **Position 1 and Position 2.** For the purpose of freeboard assignment in accordance with the requirements of the Canada Shipping Act, Load Line Regulations (Inland), see Ch 4, 1.1 Application, the definition given in Pt 3, Ch 1, 6.5 Position 1 and Position 2 of the Rules for Ships, shall apply.

### 1.5 Equivalents

1.5.1 Alternative arrangements or fittings, which are considered to be equivalent to the requirements of these Rules, will be accepted.

### 1.6 Inspection, workmanship and testing procedures

1.6.1 Requirements are to be in accordance with Pt 3, Ch 1, 8 Inspection and workmanship of the Rules for Ships.

## Section 2 Materials

### 2.1 General

2.1.1 All materials, including steel castings and forgings used for sternframes, rudders, rudder stocks, rudder pintles, rudder palm bolts and propeller shaft brackets, are to comply with the relevant sections of the *Rules for the Manufacture, Testing and Certification of Materials* (hereinafter referred to as the Rules for Materials) and Pt 3, Ch 2 Materials of the Rules for Ships, except as indicated in Ch 4, 2.2 Rolled steel plates, strip, sections and bars and Ch 4, 2.3 Protection of steelwork of these Rules.

2.1.2 The requirements for welding are given in Pt 3, Ch 10 Welding and Structural Details of the Rules for Ships.

2.1.3 Conversion of units from SI to metric, are given in Ch 1, 4.5 Mechanical tests and Table 1.4.1 Conversions from SI units to metric and Imperial units of the Rules for Materials.

### 2.2 Rolled steel plates, strip, sections and bars

2.2.1 Steel, when manufactured in accordance with Canadian Standards Association (CSA) G40.21 may be accepted as equivalent to LR grades, see Table 4.2.1 CSA Equivalent Steel Grades. This is subject to the steel being certified by LR and manufactured at a steel works approved for the manufacture of the equivalent LR grade. The CSA grade is to have the same condition of supply and combination of grain refining elements as the LR approved grades.

**Table 4.2.1: CSA Equivalent Steel Grades**

CSA Grade LR Grade (38W)	260W (38WT)	260WT (44W)	300W (44WT)	300WT (50W)	350W (50WT)	350WT
A	√	√	√	√	√	√
B	(1)	CSA category 2 <sup>(2)</sup>	(1)	CSA category 2 <sup>(2)</sup>	(1)	CSA category 2 <sup>(2)</sup>
D	–	CSA category 3	–	CSA category 3	–	CSA category 3
E	–	CSA category 4	–	CSA category 4	–	CSA category 4
AH27S	(1)	CSA category 2 <sup>(2)</sup>	(1)	CSA category 2 <sup>(2)</sup>	(1)	CSA category 2 <sup>(2)</sup>
DH27S	–	CSA category 3	–	CSA category 3	–	CSA category 3

# Ship Structures

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EH27S	–	CSA category 4	–	CSA category 4	–	CSA category 4
AH32	–	–	(1)	CSA category 2 <sup>(2)</sup>	(1)	CSA category 2 <sup>(2)</sup>
DH32	–	–	–	CSA category 3	–	CSA category 3
EH32	–	–	–	CSA category 4		CSA category 4
AH36	–	–	–	–	(1)	CSA category 2 <sup>(2)</sup>
DH36	–	–	–	–	–	CSA category 3
EH36	–	–	–	–	–	CSA category 4
<p><b>Note 1.</b> Steel may be accepted with a thickness of <math>t \leq 12,5</math> mm when supplied in the fine grained condition, and for thicknesses in the range of <math>12,5 \text{ mm} &lt; t \leq 50</math> mm, steel may be accepted subject to it being fine grained and normalized. Additionally, for thicknesses in the range of <math>12,5 \text{ mm} &lt; t \leq 50</math> mm, the IIW carbon equivalent value (CEV) is to be less than 0,45%.</p> <p><b>Note 2.</b> Steel may be accepted under CSA category 1 if the actual certified Charpy value exceeds 27 Joules for normal strength and higher strength 27S steels, and exceeds 31 Joules for higher strength 32 and exceeds 34 joules for higher strength 36 steels.</p>						

2.2.2 The frequency of testing is to be as stated in the Rules for Materials for the equivalent grade.

2.2.3 The limit for the specified minimum yield stress in mild steel is stated in Pt 3, Ch 2, 1.2 Steel of the Rules for Ships. Steel having a higher specified minimum yield stress is regarded as higher tensile steel.

2.2.4 For the determination of the hull girder section modulus where higher tensile steel is used, a higher tensile steel factor  $k_L$  as given in Table 2.1.1 Values of  $k_L$  of the Rules for Ships will apply.

### 2.3 Protection of steelwork

2.3.1 Pt 3, Ch 2, 3 Corrosion protection is applicable except that for vessels for freshwater service only, it may be considered suitable not to apply protection to the underwater portion of the hull. The limit of service for fresh water operation is the St. Lawrence River, west of the eastern end of the Ile d'Orleans, see Figure 4.1.1 Sketch of the map of the Gulf of St. Lawrence and River St. Lawrence showing the seaward and fresh water limits of service.

2.3.2 The requirements of Pt 4, Ch 1, 2.2 Protection of steelwork to Pt 4, Ch 1, 2.2 Protection of steelwork, are to be complied with, except that the increase of 5 mm min. on the inner bottom plating, for cargoes to be regularly discharged by grabs, as per Pt 4, Ch 1, 2.2 Protection of steelwork of the Rules for Ships, on self-unloading bulk carriers, under the cargo holds, may be omitted.

### 2.4 Structural details

2.4.1 The requirements specified in Pt 3, Ch 10, 5.2 Arrangements at intersections of continuous secondary and primary members of the Rules for Ships, are applicable except that when using Table 10.5.1 Total load transmitted to connection of secondary members, in determination of the loads,  $D_2$ , in metres is to be taken as the least of  $D$  or  $1,6T$  or  $T + C_{wL}$ .  $C_{wL}$  is to be as defined in Ch 4, 5.1 General.

## ■ Section 3

### Longitudinal strength

#### 3.1 Definitions

3.1.1 The following symbols and definitions are applicable to this Chapter, unless otherwise stated:

$L_s$  = length of the vessel, measured as the distance, in metres, on the summer load waterline from the forward side of the stem to the after side of the rudder post or the centre of the rudder stock if there is no rudder post.

$B, D, T$  = are as defined in Pt 3, Ch 1, 6.1 Principal particulars of the Rules for Ships.

$k_L, k$  = higher tensile steel factor, see Ch 3, 2 Annual Surveys – Hull and machinery requirements, Material and Protection, and Pt 3, Ch 2, 1.2 Steel of the Rules for Ships.

#### 3.2 General

3.2.1 Longitudinal strength calculations are to be carried out for all ships where  $L_s$  is greater than 65 metres, covering the range of load and ballast conditions proposed, in order to determine the required hull girder strength. The calculations of still water shear forces and bending moments are to cover both departure and arrival conditions. See Pt 3, Ch 4, 5.3 Design still water bending moments of the Rules for Ships.

#### 3.3 Information required

3.3.1 In order that an assessment of the longitudinal strength requirements can be made, the information listed in Pt 3, Ch 4, 4.1 List of requirements of the Rules for Ships is to be submitted in LR's standard format, where appropriate.

#### 3.4 Hull bending strength

3.4.1 The symbols used in this sub-Section are defined as follows:

$M_U$  = standard still water bending moment in kN m (tonne-f m), see 3.4.5

$M_W$  = design wave bending moment in kN m (tonne-f m)

$M_V$  = design springing bending moment in kN m (tonne-f m)

$M_L$  = design still water bending moment in kN m (tonne-f m)

$\overline{M}_L$  = maximum permissible still water bending moment, sagging (negative) and hogging (positive), in kN m (tonne-f m), see 3.4.14

$\overline{M}_{L \text{ Harb}}$  = maximum permissible still water bending moment in harbour or equivalent environment in kN m (tonne-f m), see 3.4.15

$\sigma$  = permissible combined stress (still water plus dynamic) in N/mm<sup>2</sup> (kgf/mm<sup>2</sup>), see 3.4.13.

3.4.2 Vessels approved with the longitudinal strength requirements given in this Section should satisfy The Great Lakes Load Line (Main Hull) 1968 Strength Standard. The requirements are applicable to vessels with length  $L_s$  between 122 metres and 320 metres.

3.4.3 Longitudinal strength of the vessels with length  $L_s$  outside the limits given in 3.4.2 will be specially considered.

3.4.4 For operation in harbour waters a higher permissible still water bending moment can be assigned based on reduced combined vertical wave and springing moment, see Ch 4, 3.4 Hull bending strength.

3.4.5 The standard still water bending moment,  $M_U$ , hogging and sagging, is given by:

$$M_U = 74,62 L_s^2 B T \times 10^{-3} \text{ kNm}$$



$$(M_U = 7,607 L_S^2 B T \times 10^{-3} \text{ tonne-f m})$$

3.4.6 The hull midship section modulus about the transverse neutral axis, at the deck or the keel, is to be not less than:

$$Z_{\min} = k_L 69,44 L_S^2 B Z_1 \times 10^{-8} \text{ m}^3$$

where

$$Z_1 = Z_0 + 0,551 K T$$

$Z_0$  = modulus coefficient given in Table 4.3.1

$$K = 0,65 + 0,165 C \text{ when } M_L \text{ is equal or lesser than } M_U$$

= or

$$K = \frac{C}{2,12} \text{ when } M_L \text{ is greater than } M_U$$

The still water bending moment coefficient  $C$  is given by:

$$C = 28,41 \frac{M_L}{L_S^2 B T} \text{ when } M_L \text{ expressed in kN m}$$

$$(C = 278,71 \frac{M_L}{L_S^2 B T} \text{ when } M_L \text{ expressed in tonne-f m})$$

For draught larger than 8,6 m, the section modulus will be specially considered.

3.4.7 For materials to be included in the calculation of actual hull section properties, see Pt 3, Ch 3, 3.4 Calculation of hull section modulus of the Rules for Ships.

3.4.8 Scantlings of all longitudinal members of the hull girder based on the minimum section modulus requirements given in 3.4.6 are to be maintained within  $0,67 L_S$  amidships for  $\frac{L_S}{D} = 21$  and above, and within  $0,4 L_S$  for  $\frac{L_S}{D} = 17$  and below. Intermediate values are to be determined by linear interpolation.

3.4.9 The scantlings of all longitudinal continuous material may be tapered from the midship extremities as defined in 3.4.8, to the fore and aft ends of the ship. Also see the relevant sections within Pt 3, Ch 4 Longitudinal Strength and Pt 3, Ch 5 Fore End Structure of the Rules for Ships relating to taper and material outside of the mid-body section.

3.4.10 The design still water bending moment,  $M_L$ , hogging and sagging, is the maximum moment calculated from the loading conditions.

3.4.11 The design springing bending moment  $M_V$  is given by:

$$M_V = \frac{1042,58 Z_{\min} \left( \frac{Z_1}{L_S} \right) - 1,34075 \left[ \frac{D}{(T + 0,25B)} \right] - 0,34075}{k_L} \text{ kN m}$$

$$(M_V = \frac{106,278 Z_{\min} \left( \frac{Z_1}{L_S} \right) - 1,34075 \left[ \frac{D}{(T + 0,25B)} \right] - 0,34075}{k_L} \text{ tonne-f m})$$

3.4.12 The design wave bending moment  $M_W$  is given by:

$$M_W = \frac{699200}{Z_1 k_L} Z_{\min} (33,888 L_S^3 \times 10^{-9} - 28,366 L_S^2 \times 10^{-6} + 4,723 L_S \times 10^{-3} + 1,581) \text{ kN m}$$

$$(M_W = \frac{71280}{Z_1 k_L} Z_{\min} (33,888 L_S^3 \times 10^{-9} - 28,366 L_S^2 \times 10^{-6} + 4,723 L_S \times 10^{-3} + 1,581) \text{ tonne-f m})$$

# Ship Structures

## Chapter 4

### Section 3

3.4.13 The maximum permissible combined stress (still water plus dynamic) for hull vertical bending,  $\sigma$  within amidships region defined in 3.4.8 under the standard still water bending moment defined in 3.4.5, is given by:

$$\sigma = \frac{193}{k_L} \text{ N/mm}^2 \left( \frac{19,67}{k_L} \text{ kgf/mm}^2 \right)$$

3.4.14 The permissible still water bending moment,  $\overline{M}_L$ , is to be achieved in the maximum section modulus calculation. The permissible still water bending moment is not to be exceeded for all loading conditions.

**Table 4.3.1: Values of modulus coefficient,  $Z_0$**

Value of $\left( \frac{L_S}{0,3048} \right)$	Value of $\left( \frac{D}{T + 0,25B} \right)$						
	0,6	0,7	0,8	0,9	1,0	1,1	1,2
400	6,67	6,63	6,59	6,57	6,54	6,51	6,47
450	6,70	6,65	6,61	6,59	6,56	6,52	6,48
500	6,73	6,68	6,63	6,61	6,57	6,53	6,49
550	6,76	6,71	6,65	6,63	6,59	6,54	6,50
600	6,80	6,74	6,68	6,64	6,60	6,55	6,51
650	6,84	6,77	6,71	6,66	6,61	6,56	6,52
700	6,88	6,81	6,74	6,68	6,62	6,58	6,53
750	6,96	6,86	6,77	6,70	6,64	6,59	6,54
800	7,06	6,92	6,81	6,73	6,66	6,60	6,55
850	7,16	7,01	6,88	6,78	6,69	6,62	6,56
900	7,27	7,10	6,95	6,83	6,73	6,64	6,57
950	7,42	7,22	7,05	6,91	6,80	6,71	6,62
1000	7,57	7,35	7,18	7,04	6,92	6,82	6,72
1050	7,76	7,53	7,34	7,18	7,05	6,94	6,83
<b>Note</b> Intermediate values of $Z_0$ are to be obtained by linear interpolation.							

3.4.15 The permissible still water bending moments, sagging or hogging, in harbour for the draught under consideration are not to exceed the following value:

$$\overline{M}_{L\text{Harb}} = \overline{M}_L + 0,45 \sqrt{M_W^2 + M_V^2} \text{ kN m (tonne - f m)}$$

3.4.16 The hull midship section moment of inertia about transverse neutral axis is to be not less than the following:  
for the vessels with length  $L_S$  equal to 122 metres and below

$$I_{\min} = \frac{3L_S Z_{\min}}{100k_L} \text{ m}^4$$

for the vessels with length  $L_S$  between 122 metres and 213 metres

$$I_{\min} = \frac{(L_S + 243,8) Z_{\min}}{100k_L} \text{ m}^4$$

for the vessels with length  $L_S$  equal to 213 metres and over

$$I_{\min} = \frac{2,15 L_S Z_{\min}}{100 k_L} \text{ m}^4$$

### 3.5 Hull shear strength

3.5.1 Shear strength requirements of the vessels with length  $L_S$  greater than 65 metres is to be investigated.

3.5.2 Shear strength of the vessels with length  $L_S$  between 122 metres and 320 metres is to be in accordance with this Section. Shear strength of the vessels with length  $L_S$  outside the limits given above will be specially considered.

3.5.3 For operation in harbour waters a higher permissible still water shear forces can be assigned based on reduced combined dynamic shear forces, see 3.5.8.

3.5.4 The following symbols are applicable to this Section, unless otherwise stated:

$I, A_Z, Q$  = are as defined in Pt 3, Ch 4, 6.1 Symbols of the Rules for Ships.  
 $Q_S, Q_W,$   
 $\tau, \tau_A$

$Q_W$  = design dynamic shear force calculated using  $Q_{W0}$  defined in 3.5.5 in kN (tonne-f)

$\tau$  = permissible combined shear stress (still water plus dynamic), in  $\text{N/mm}^2$  ( $\text{kgf/mm}^2$ ), see 3.5.9.

3.5.5 The design hull dynamic shear force,  $Q_W$ , at any position along the ship is to comply with the requirements of Pt 3, Ch 4, 6.3 Design wave shear force of the Rules for Ships, except that  $Q_{W0}$  and  $K_2$  are to be taken as defined below:

$$Q_{W0} = \frac{3 \sqrt{M_{W2}^2 + M_V^2}}{L_S} \text{ kN (tonne - f)}$$

$$K_2 = 1,0$$

3.5.6 The design still water shear force,  $Q_S$ , at each transverse section along the hull is to be taken as defined in Pt 3, Ch 4, 6.4 Design still water shear force of the Rules for Ships, as applicable.

3.5.7 The permissible hull still water shear force is to comply with the requirements of Pt 3, Ch 4, 6.5 Permissible still water shear force of the Rules for Ships. Value of  $Q_W$  used in calculations is to be taken as given in 3.5.4.

3.5.8 The permissible still water shear forces, positive or negative, in harbour or equivalent environment are not to exceed the following value:

$$|Q_{SH}| = |Q_S| + |0,45 Q_W|$$

where

$Q_{SH}$  = still water shear force in harbour

$Q_S$  = still water shear force as calculated in 3.5.7

$Q_W$  = wave shear force as given in 3.5.4

3.5.9 The permissible combined shear stress  $\tau$  (still water plus dynamic) is to be taken as:

$$\tau = \frac{110}{k_L} \text{ N/mm}^2 \left( \frac{11,2}{k_L} \text{ kgf/mm}^2 \right)$$

3.5.10 The design shear stress is to comply with the requirements of Pt 3, Ch 4, 6.7 Design shear stress of the Rules for Ships. Value of  $Q_W$  used in calculations is to be taken as given in 3.5.4.

### 3.6 Hull buckling strength

3.6.1 The requirements of Pt 3, Ch 4, 7 Hull buckling strength of the Rules for Ships are applicable within amidships section defined in Pt 3, Ch 4, 7.1 Application of the Rules for Ships.

3.6.2 When carrying out buckling calculations the standard corrosion deduction ranges,  $d_t$  range mm, given in Table 4.7.1 Standard deduction for corrosion,  $d_t$  of the Rules for Ships, are to be substituted as follows:

items (a) and (b)	0,5	—	1,0
items (c) and (d)	1,0	—	1,5
item (e)	1,5	—	2,0

### 3.7 Loading guidance information

3.7.1 The requirements of Pt 3, Ch 4, 8 Loading guidance information of the Rules for Ships are to be complied with.

3.7.2 Where ballast water is carried in the cargo holds of non self-unloading bulk carriers, the sailing condition is to be included in the loading manual for approval, as per Pt 3, Ch 4, 8 Loading guidance information of the Rules for Ships.

3.7.3 New ships to which the Load Line Regulation (Inland) are applicable, will be assigned class, only after it has been verified that the level of intact stability is approved by the National Authority.

## ■ Section 4 Deck structure

### 4.1 General

4.1.1 The strength deck, outside the line of openings, is to be longitudinally framed throughout the cargo hold region. The strength deck, inside the line of openings, may also be longitudinally framed.

4.1.2 The requirements of Pt 4, Ch 1, 4 Deck structure of the Rules for Ships are to be applied, together with the additional requirements of this Section.

### 4.2 Deck plating

4.2.1 The thickness of the strength deck plating, outside the line of openings, is to be maintained as per Pt 3, Ch 4, 7.1 Application of the Rules for Ships, and may be tapered to Rule thickness at ends.

4.2.2 The thickness of the strength deck plating, inside the line of openings and clear of the screen bulkhead under, is to be taken as:

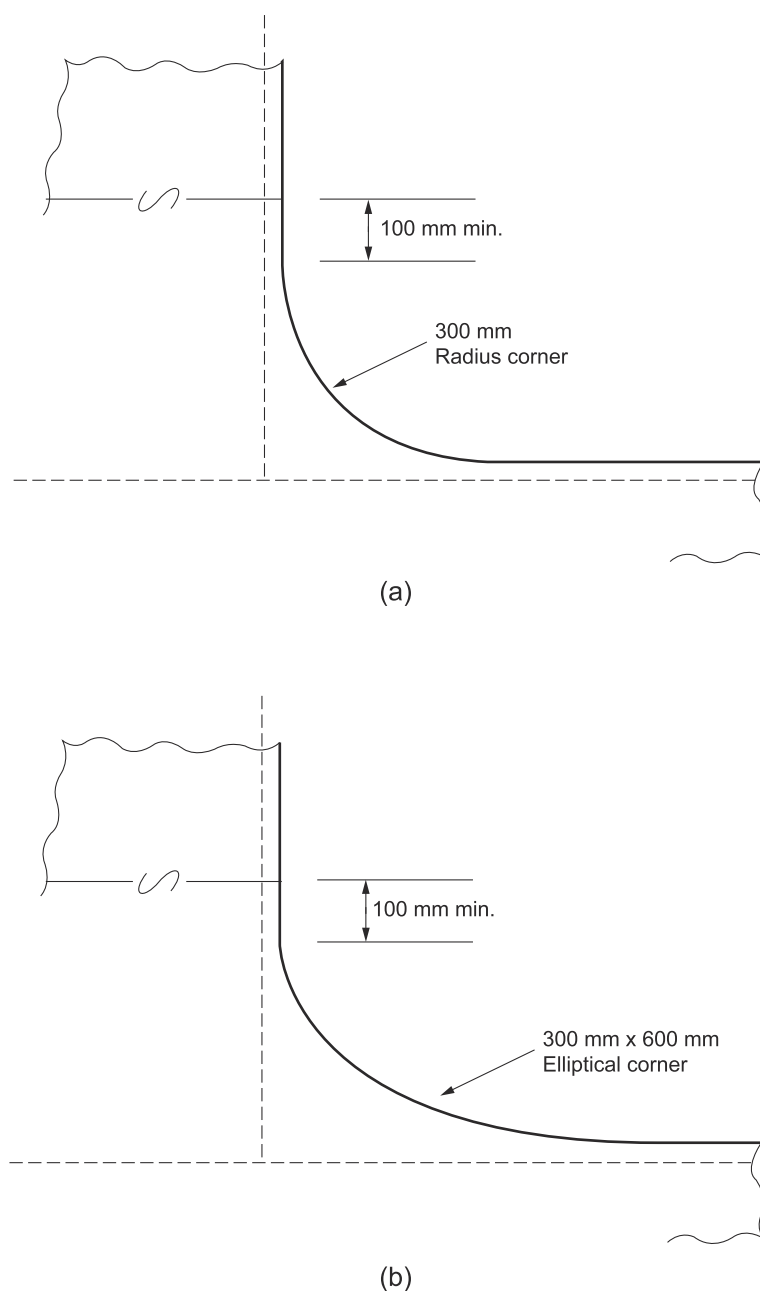
$$t = 0,01s\sqrt{k} \text{ but not less than } 9,5 \text{ mm}$$

where

$$s_1 = s \text{ but is not to be taken less than } 470 + \frac{L}{0,6}$$

s is spacing of secondary stiffeners, in mm.

4.2.3 The strength deck plate thickness outside the line of openings, is to be continued inboard between hatches, 100 mm minimum, beyond the inboard end of the hatch corner curvature to ensure that the chamfered plating is clear of the corner tangent point. See Figure 4.4.1 Corners of main cargo hatchways.



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**Figure 4.4.1: Corners of main cargo hatchways**

4.2.4 The thickness of the underdeck passage tunnel, where fitted, at the upper side shell stringer level is to be not less than the greater of Table 1.4.2 Lower deck plating or 9,5 mm in thickness.

### 4.3 Deck stiffening

4.3.1 The scantlings of the strength deck longitudinals are to be maintained as per Pt 3, Ch 4, 7.1 Application of the Rules for Ships and may be tapered to Rule scantlings at ends.

4.3.2 The scantlings of the strength deck longitudinals are to comply with the requirements of Table 1.4.3 Strength/weather deck longitudinals of the Rules for Ships.

4.3.3 The scantlings of the strength deck beams, are to comply with the requirements of Table 1.4.5 Strength/weather, cargo and accommodation deck beams of the Rules for Ships.

4.3.4 The deck longitudinals outside the line of openings are to be continuous through the transverse structure, throughout the cargo hold region.

4.3.5 The deck transverse arch beam under and between the hatches is to comply with the requirements of Table 1.4.6 Deck girders, transverses and hatch beams of the Rules for Ships.

#### **4.4 Deck openings**

4.4.1 The corners of main cargo hatchways in the strength deck are to be elliptical or rounded. The hatch corner radii are to be 300 mm min. and the elliptical corners 600 mm min. x 300 mm min. with the major axis in a fore and aft direction, see Figure 4.4.1 Corners of main cargo hatchways.

4.4.2 Insert plates in way of the hatch corners are not generally required.

4.4.3 Where openings in the strength deck plating are arranged, outside the line of openings, the requirements of Pt 4, Ch 1, 4.5 Deck openings of the Rules for Ships, will apply, except that the longitudinal extent required for compensation is increased, see Ch 4, 3.4 Hull bending strength.

### ■ **Section 5** **Shell envelope plating**

#### **5.1 General**

5.1.1 The requirements of Pt 4, Ch 1, 5 Shell envelope plating of the Rules for Ships, are to be applied together with the requirements of this Chapter.

5.1.2 The bottom shell is to be longitudinally framed except in way of the wing tanks, where the plating may be transversely framed. Longitudinal or transverse framing may be adopted at the side shell except in way of the upper part, where longitudinal framing is to be adopted.

5.1.3 The maximum wave head, ( $C_{wL}$ ) as per Table 1.5.2 Bottom shell and bilge plating and Table 1.5.3 Side shell plating of the Rules for Ships is  $0,5 C_w$ .

5.1.4 Where bilge keels are fitted, the requirements of Pt 3, Ch 10, 5.6 Bilge keels and ground bars of the Rules for Ships are to apply.

5.1.5 Where rubbing bars are fitted, the quality of the welding is to be equivalent to that of the main structure, and the grade of material is to be similar to that of the shell plating in way. Where longitudinal rubbing bars are discontinuous throughout the ship's length, the ends of each section are to be radiused and chamfered and extend over an internal stiffening member. Direct connection between the rubbing bar butt weld and the shell plating is to be avoided.

5.1.6 It is recommended that the side shell plating be increased in thickness at the forward and aft shoulders of the ship, to accommodate contact with Seaway Locks and to resist ice damage.

#### **5.2 Keel**

5.2.1 The thickness of the keel plate may be as per the thickness of the adjacent bottom shell plating.

#### **5.3 Bottom shell and bilge**

5.3.1 The thickness of the bottom and bilge shell plating is to be not less than the minimum values given in Table 1.5.2 Bottom shell and bilge plating of the Rules for Ships.

#### **5.4 Side shell and sheerstrake**

5.4.1 The midship thickness of the side shell and sheerstrake plating is to be not less than the minimum values given in Table 1.5.3 Side shell plating of the Rules for Ships.

5.4.2 The midship thickness of the side shell and sheerstrake plating, per 5.4.1, is to be maintained as per Pt 3, Ch 4, 7.1 Application of the Rules for Ships.

## ■ *Section 6*

### **Shell envelope framing**

#### **6.1 General**

6.1.1 The requirements of Pt 4, Ch 1, 6 Shell envelope framing of the Rules for Ships are to be applied, together with the requirements of this Chapter.

6.1.2 Longitudinal framing is to be adopted at the bottom shell. Longitudinal or transverse framing may be adopted at the side shell except in way of the upper part where longitudinal framing is to be adopted.

6.1.3 The maximum wave head, ( $C_{wl}$ ) as per Table 1.6.1 (a) Shell framing (longitudinal) and Table 1.6.3 Shell framing (transverse) of the Rules for Ships is  $0,5 C_w$ .

6.1.4 The minimum thickness of longitudinal and transverse members is to be 9,5 mm.

6.1.5 It is recommended that the side shell framing, together with the side transverses and stringers be increased in scantlings, or locally reinforced, at the forward and aft shoulders of the ship to accommodate contact with Seaway Locks and to resist ice damage.

#### **6.2 Longitudinal framing**

6.2.1 The scantlings of the bottom and side shell longitudinals in the midship region are to comply with the requirements given in Table 1.6.1 (a) Shell framing (longitudinal) of the Rules for Ships.

6.2.2 Bottom longitudinals are to be generally continuous, in way of watertight and non-watertight floors, throughout the cargo hold region.

#### **6.3 Transverse framing**

6.3.1 The scantlings of main and 'tween deck frames in the midship region are to comply with the requirements given in Table 1.6.3 Shell framing (transverse) of the Rules for Ships.

## ■ *Section 7*

### **Wing tank structure**

#### **7.1 General**

7.1.1 The wing tank structure is generally to comprise the double skin side and topside structure. On a self-unloading bulk carrier, a hopper side structure may be incorporated, see Figure 4.1.2 Typical Great Lakes Bulk Carrier without self-unloading equipment.

7.1.2 Requirements given in this Section are for longitudinal or transverse framing of the side shell and longitudinal bulkhead.

7.1.3 The buckling strength requirements of Ch 4, 3.6 Hull buckling strength are to be satisfied.

7.1.4 The minimum thickness of structural members in the wing tank structure is to be 9,5 mm.

#### **7.2 Hopper side structure**

7.2.1 Hopper side structure is typically arranged in self-unloading bulk carriers.

7.2.2 The sloped hopper structure, clear of the hopper side tank structure, on self-unloading bulk carriers, is not normally included in the longitudinal strength calculations. Where it is included in the longitudinal or transverse strength calculations, the structure is to be specially considered.

7.2.3 Where the structure is longitudinally framed, transverses are to be arranged in the hopper side structure in alignment with the double bottom floors to ensure continuity of transverse strength.

7.2.4 The scantlings of hopper structures are to be determined to satisfy the following:

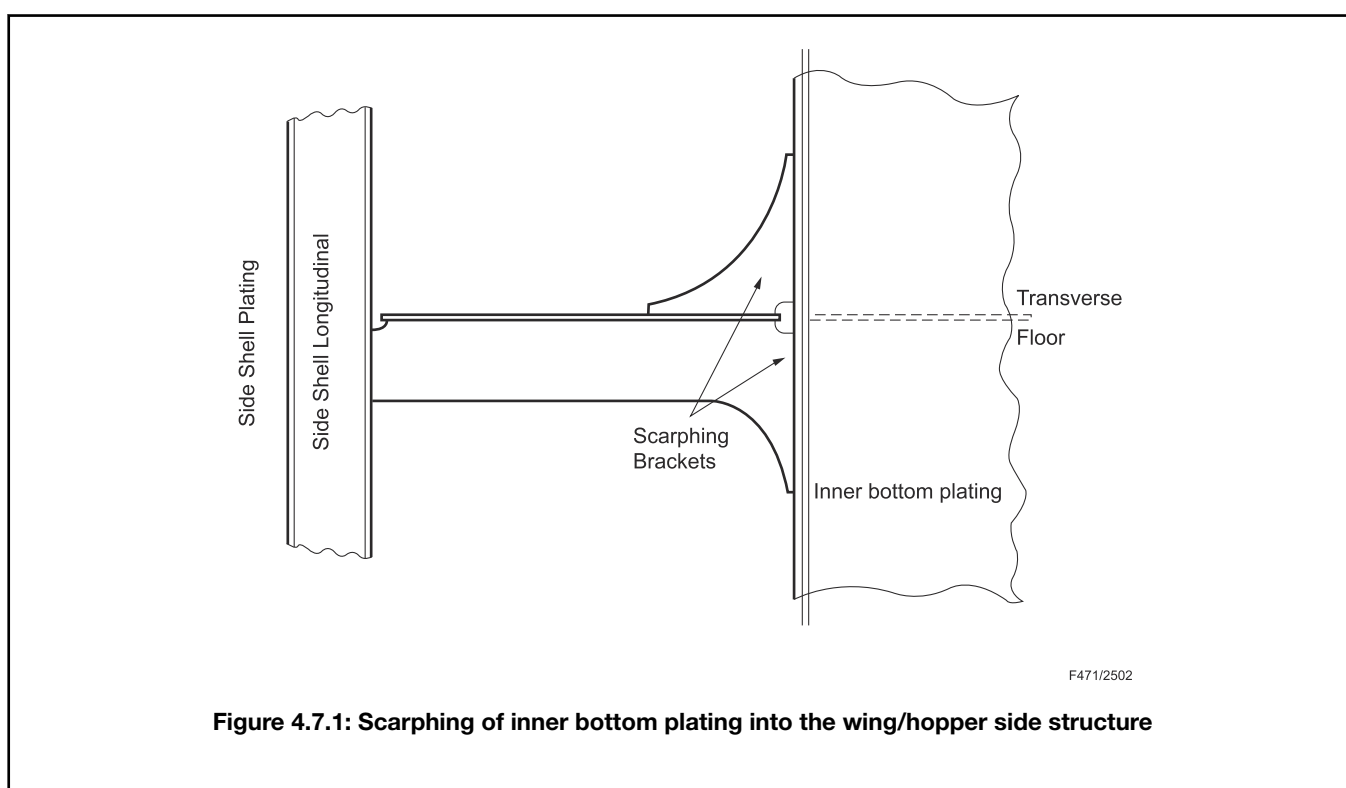
- (a) Deep tank requirements if applicable.
- (b) Cargo loading requirements.

The deep tank requirements are given in Rules for Ships, Table 1.9.1 Watertight and deep tank bulkhead scantlings. The cargo loading requirements are to be specially considered.

7.2.5 The scantlings of the sloped hopper bulkhead transverses are to comply with the requirements of Table 7.9.1 Hopper tank primary structure of the Rules for Ships, with a maximum stowage rate of 1,00 m<sup>3</sup>/tonne. Alternative scantlings may be considered based on direct calculations.

7.2.6 Where the breadth of the double bottom structure exceeds the breadth of the hopper tank structure over the breadth of the ship, suitable scarphing of the inner bottom plating is to be arranged into the wing bottom structure by horizontal scarphing brackets, fitted in line with the inner bottom plating at each transverse. These brackets are to be arranged on each side of the transverse, see Figure 4.7.1 Scarphing of inner bottom plating into the wing/hopper side structure.

7.2.7 Where the bottom and side shell structure and the sloped longitudinal bulkhead are transversely framed, the transverse web frames are to be in line with the double bottom floors and the single bottom floors integrated into the double bottom structure, see Figure 4.8.1 Floor.



7.2.8 The scantlings of the sloped longitudinal bulkhead are to be in accordance with the greater of Table 7.8.1 Strengthening for heavy cargo requirements of the Rules for Ships, using a head of cargo measured vertically from the location under consideration to the strength deck at side or underside of topside tank with a maximum stowage rate not exceeding 1,00 m<sup>3</sup>/tonne. The scantlings are also to comply with Table 1.9.1 Watertight and deep tank bulkhead scantlings of the Rules for Ships and are to be maintained throughout the cargo region.

### **7.3 Double skin side structure**

7.3.1 The double skin and vertical longitudinal bulkhead may be either longitudinally or transversely framed.

7.3.2 Where the side shell and the vertical longitudinal bulkhead are transversely framed, the transverse web frames are to be in line with floors in the double bottom. The single bottom floors in the side structure are to be arranged with the free edge suitably stiffened.

7.3.3 Where the double skin structure is longitudinally framed, the transverses are to be in line with the transverses below and horizontal stringers are to be arranged at the upper and lower knuckle connections of the longitudinal bulkhead. The stiffening of the knuckle connection is to be specially considered.

7.3.4 The scantlings of the vertical longitudinal bulkhead are to be in accordance with Table 1.9.1 Watertight and deep tank bulkhead scantlings of the Rules for Ships and are to be maintained throughout the cargo region.



**7.4 Topside structure**

7.4.1 The topside structure is to be longitudinally framed.

7.4.2 The thickness of the sloped longitudinal bulkhead plating is to be in accordance with Pt 4, Ch 7, 7.2 Bulkhead plating of the Rules for Ships.

7.4.3 The section moduli of the longitudinal bulkhead stiffeners, are to be in accordance with Pt 4, Ch 7, 7.3 Bulkhead stiffeners of the Rules for Ships, with  $h_4$  value, the greater of the distance in metres from the middle of the effective length to the top of the tank, or half the distance to the top of the overflow or 1,5 m, whichever is the greatest.

7.4.4 Transverse web frames are to be in line with the transverses in the double skin structure below and transverse arch webs in the cargo holds under the cross deck strips and are to be suitably stiffened.

**7.5 Tank end bulkheads**

7.5.1 The scantlings of the tank end bulkheads are to comply with the requirements for deep tanks in Table 1.9.1 Watertight and deep tank bulkhead scantlings of the Rules for Ships.

7.5.2 Where possible, the location of the transverse tank end bulkheads are to be in line with the transverse screen bulkheads in the cargo holds.

## ■ *Section 8* **Double bottom structure**

**8.1 Definitions**

8.1.1 Breadth,  $B$ , in the calculations of the double bottom structure, is to be as per Pt 3, Ch 1, 6.1 Principal particulars of the Rules for Ships and where a hopper side structure has been arranged as per Ch 4, 7.2 Hopper side structure the moulded distance, in metres, may be between the longitudinal bulkheads.

**8.2 General**

8.2.1 A double bottom structure is generally to be fitted from the collision bulkhead to the after peak bulkhead, and between the side tank longitudinal bulkheads in the cargo hold region, compatible with the design and proper working of the ship.

8.2.2 The requirements of Pt 4, Ch 1, 8 Double bottom structure of the Rules for Ships are to be applied, together with the requirements of this Section.

8.2.3 Longitudinal framing is to be adopted in way of the cargo hold region.

8.2.4 Where the double bottom tanks are interconnected with the wing tank structure, the double bottom scantlings are also to satisfy the requirements of Pt 4, Ch 1, 9 Bulkheads of the Rules for Ships.

8.2.5 The additional requirements for ships specially strengthened for heavy cargoes are given in Pt 4, Ch 7, 1.3 General class notations of the Rules for Ships.

8.2.6 The buckling requirements of Ch 4, 3.6 Hull buckling strength are to be satisfied.

8.2.7 Special consideration is to be given to double bottom structure for self-unloading bulk carriers.

**8.3 Girders**

8.3.1 Where a centre girder is to be arranged, a vertical ordinary angle stiffener (or equivalent) may be fitted on one side with a max. spacing 1,00 m, in lieu of a docking bracket.

8.3.2 Side girders, generally two each side of the centreline, are to be fitted in addition to the side tank bulkhead.

8.3.3 Alternative arrangements will be considered on the basis of the results of direct calculations.

8.3.4 Duct keels, where arranged, are to comply with the requirements of Pt 4, Ch 1, 8.3 Girders of the Rules for Ships.

**8.4 Inner bottom plating and stiffening**

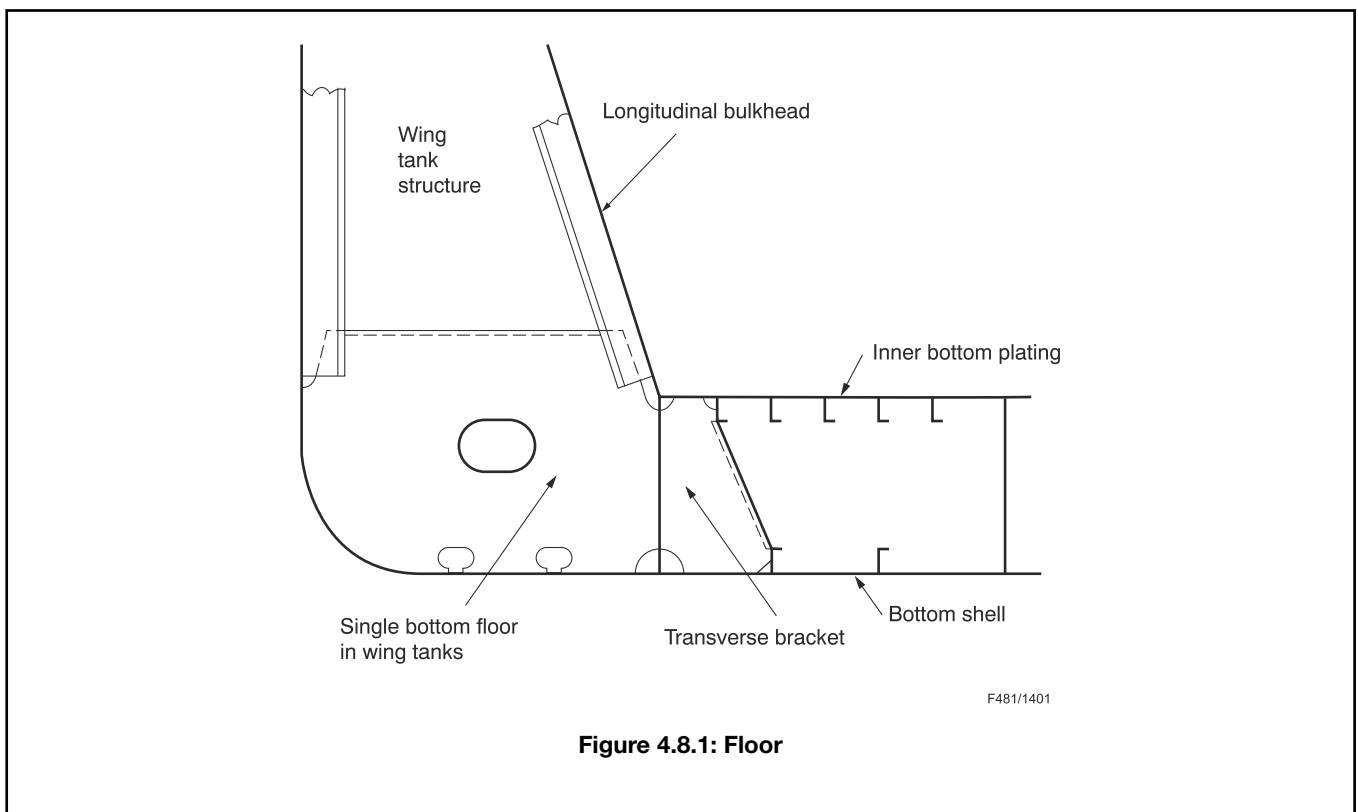
8.4.1 The minimum thickness of the inner bottom plating on a non self-unloading bulk carrier is to be according to Table 7.8.1 Strengthening for heavy cargo requirements of the Rules for Ships, in association with a maximum stowage rate not exceeding

1,00 m<sup>3</sup>/tonne. For self-unloading bulk carriers, the minimum thickness is to be as per Pt 4, Ch 1, 8.4 Inner bottom plating and stiffening of the Rules for Ships.

8.4.2 On self-unloading bulk carriers, the vertical pillars from the cargo hopper support structure clear of the hopper side structure are to be arranged in line with floor and inner bottom longitudinal intersections. Doubling plates shall be arranged on the inner bottom plating under the heels of the vertical pillars. The inner bottom longitudinal slots in the double bottom floors under the vertical pillars are to be closed with collars, where necessary.

## 8.5 Floors

8.5.1 Where transverse framing is adopted in the wing tanks and longitudinal framing inboard of the longitudinal bulkhead, a transverse bracket is to be arranged in line with the outboard single bottom floor, inboard of the longitudinal bulkhead, extending to the first bottom shell longitudinal inboard of the longitudinal bulkhead, see Figure 4.8.1 Floor.



## ■ Section 9 Bulkheads

### 9.1 General

9.1.1 For watertight and deep tank bulkheads, including the engine room bulkhead at the after end of the after cargo hold and the after peak bulkhead, the requirements of Pt 4, Ch 1, 9 Bulkheads of the Rules for Ships will apply.

9.1.2 The corrosion allowance, to be added to the plating criteria in Table 1.9.1 Watertight and deep tank bulkhead scantlings of the Rules for Ships, for deep tank bulkheads is to be 1,5 mm.

### 9.2 Number of bulkheads

9.2.1 The requirements of Pt 3, Ch 3, 4.1 Number and disposition of bulkheads of the Rules for Ships are to be complied with, except that the transverse bulkheads in the cargo holds may be dispensed with.

**9.3 Collision bulkhead**

9.3.1 The collision bulkhead is to be positioned approximately  $0,04 L_L$  aft of the fore end of  $L_L$  (with  $L_L$  as defined in Pt 3, Ch 1, 6.1 Principal particulars of the Rules for Ships).

9.3.2 The scantlings are to comply with the requirements of Pt 4, Ch 1, 9 Bulkheads of the Rules for Ships, except that the thickness of plating and modulus of stiffeners are to be not less than 12% greater and 25% greater, respectively, than would be required for a dry space.

9.3.3 Doors, manholes, permanent access openings or ventilation ducts are not to be cut in the collision bulkhead below the freeboard deck, see also Pt 5, Ch 13, 3 Drainage of compartments, other than machinery spaces of the Rules for Ships. The number of openings in collision bulkheads above the freeboard deck is to be kept to a minimum compatible with the design and proper working of the ship. All such openings are to be fitted with means of closing to weathertight standards.

**9.4 Non-watertight screen hold bulkheads**

9.4.1 The number and location of screen bulkheads to be fitted are to satisfy the operational requirements of the ship.

9.4.2 These requirements apply to the non-watertight, transverse, screen bulkheads, in the cargo holds, which are loaded homogeneously on both sides with cargo.

9.4.3 The definition of a screen bulkhead is given in Ch 4, 1.4 Definitions.

9.4.4 The requirements of this Chapter apply to a vertical system of stiffening on screen bulkheads. They may also be applied to a horizontal system of stiffening or a combination, provided that equivalent end support and alignment are provided, see Fig. 1.3.2 (a) and (b) of Pt 4, Ch 4 of the Rules for Ships.

9.4.5 Where screen bulkheads are designed to withstand non-uniform cargo loading, the scantlings and arrangements will be specially considered.

9.4.6 The minimum plating requirements are to comply with the bulkhead requirements, as stated in Table 1.9.1 Watertight and deep tank bulkhead scantlings of the Rules for Ships. Minimum thickness is to be 12,0 mm in lower part and 9,5 mm in upper.

9.4.7 The minimum stiffening requirements of Table 1.9.1 Watertight and deep tank bulkhead scantlings of the Rules for Ships for watertight bulkheads are to be complied with, the load head  $h_4$ , being restricted to  $0,5 h_4$ .

■ **Section 10**  
**Fore peak structure**

**10.1 General**

10.1.1 The requirements of Pt 3, Ch 5, 6 Fore peak structure of the Rules for Ships are to be complied with, except as otherwise specified in this Section.

10.1.2 The requirements given, are those specific to the fore peak tank structure, forward of the cargo hold region and forward of the collision bulkhead.

10.1.3 The head ( $h_{T1}$ ) criteria to be used for shell envelope framing in Pt 3, Ch 5, 6 Fore peak structure of the Rules for Ships, is to be as per Section 6.

**10.2 Collision bulkhead**

10.2.1 The location and scantlings of the collision bulkhead are to be as per Ch 4, 9.3 Collision bulkhead.

**10.3 Strengthening of bottom forward**

10.3.1 The requirements of Pt 3, Ch 5, 1.5 Strengthening of bottom forward of the Rules for Ships, do not require to be complied with.

**10.4 Strengthening against bow flare slamming**

10.4.1 The requirements of Pt 3, Ch 5, 1.6 Strengthening against bow flare slamming of the Rules for Ships, do not require to be complied with.

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**■** *Section 11***Superstructures, deckhouses and machinery space openings****11.1 General**

11.1.1 For the structure of superstructures and deckhouses, the requirements of Pt 3, Ch 8 Superstructures, Deckhouses and Bulwarks of the Rules for Ships are to be complied with.

11.1.2 The design pressure head,  $h$ , to be used in the determination of erection scantlings, is to be taken as equal to one tier higher than equivalent tier, as stated in Pt 3, Ch 8, 1.4 Design pressure head of the Rules for Ships.

**11.2 Machinery space openings**

11.2.1 Machinery space openings in Positions 1 and 2 shall be suitably framed and closed by doors with suitable closing arrangements, commensurate with their size and location.

11.2.2 Any funnel or machinery space ventilator that must be kept open for the essential operations of the ship shall have coamings of a height above deck of at least 3,81 m in Position 1 and 1,83 m in Position 2.

---

**■** *Section 12***Closing arrangements for deck and shell****12.1 Hatch covers**

12.1.1 The requirements are given for single panel, steel plated or equivalent, cargo hatch covers, stiffened longitudinally and secured around the perimeter by manual 'kestner' type, clamping devices. The hatch covers are, in general, lifted by a travelling gantry deck crane.

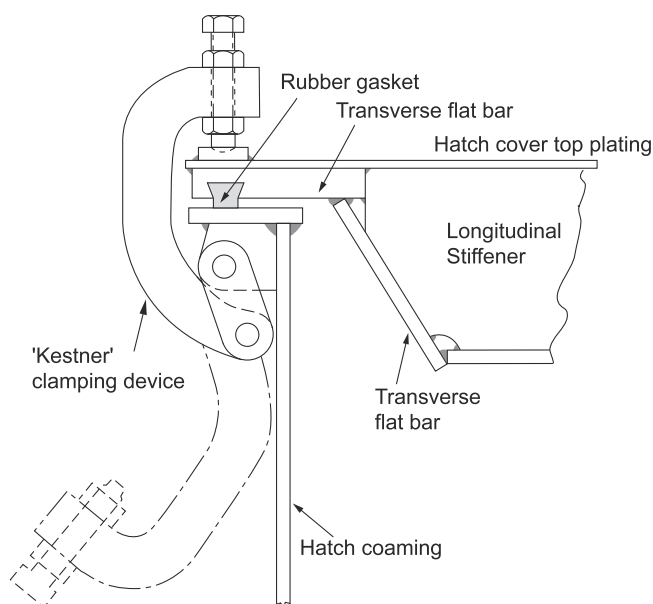
12.1.2 For hatch covers of other types and designs, the scantlings will be specially considered.

12.1.3 The definition of the Positions 1 and 2 of hatches on the strength deck is stated in Ch 4, 1.4 Definitions.

12.1.4 Where hatch covers are manufactured from material other than steel, then direct equivalency to these requirements is to be complied with.

**12.2 Means to ensure weathertightness**

12.2.1 The typical weathertight sealing arrangement, in general, is achieved by a rubber gasket on the hatch cover, compressed onto the top rail of the hatch coaming, see Figure 4.12.1 Typical hatch cover sealing arrangement.



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**Figure 4.12.1: Typical hatch cover sealing arrangement**

12.2.2 For testing of hatch covers after installation, the requirements of Pt 3, Ch 11, 4.2 Steel covers – Clamped and gasketed and Pt 3, Ch 11, 4.2 Steel covers – Clamped and gasketed of the Rules for Ships will apply.

12.2.3 The spacing of the perimeter clamping devices shall satisfy the requirements of Pt 3, Ch 11, 4.2 Steel covers – Clamped and gasketed of the Rules for Ships.

12.2.4 The clamping devices may be cast or fabricated.

### 12.3 Plating

12.3.1 The thickness of the plating of the hatch cover is to be not less than 6,0 mm or  $0,01s\sqrt{k}$ , whichever is greater, where  $s$  is the spacing of longitudinals or stiffeners (shorter panel dimension), in mm.

### 12.4 Stiffeners

12.4.1 The scantlings and strength criteria of the hatch cover stiffeners are to be as follows:

- For ships 106,7 m in length and greater, calculated with design loading for Position 1, not less than 1,22 tonne-f/m<sup>2</sup> and for Position 2, not less than 0,97 tonne-f/m<sup>2</sup>, with an equivalent design head of 1,70 m and 1,35 m respectively. The product of the maximum stress thus calculated and the factor of 4,25 shall not exceed the minimum tensile strength of the material, with the maximum permissible deflection limited to not more than 0,0028 times the span.
- For ships 24,1 m in length, the design loading on the hatch cover for Position 1, may be 0,97 tonne-f/m<sup>2</sup> and for Position 2, may be 0,73 tonne-f/m<sup>2</sup> with an equivalent design head of 1,35 m and 1,01 m respectively.
- For intermediate lengths the values shall be obtained by linear interpolation.

The maximum permissible shear stress criteria shall be as per Table 11.2.3 Effective breadth  $e$  m of plating of primary supporting members of the Rules for Ships.

12.4.2 Additional stiffening members are generally also arranged, so as to provide suitable rigidity to the hatch cover during the lifting operation.

**12.5 Hatch coamings**

12.5.1 Hatch coamings, either vertical at sides or ends or sloped at sides, are to have a minimum thickness of 11 mm. The top edge is to be stiffened by a horizontal flat bar or equivalent, 75 mm min. in width.

12.5.2 Additional support is to be given to the hatch coamings by the fitting of stays not more than 3 m apart. Each stay, min. 9,5 mm thickness, is to be suitably supported under the deck.

12.5.3 Where hatch side coamings are sloped, the support arrangements of the coaming will be specially considered.

12.5.4 The deck plating is generally to extend inside the coamings.

12.5.5 A hatch end beam is to be arranged under the hatch end coaming. Transverse continuation brackets are to be arranged outboard of the hatches in line with the hatch end beam.

12.5.6 The height of the coamings above the upper surface of the deck, for hatchways, closed by covers secured weathertight by clamping devices shall be:

Position 1 (as defined in Ch 4, 1.4 Definitions) – 460 mm

Position 2 (as defined in Ch 4, 1.4 Definitions) – 305 mm

12.5.7 Where coamings of less height than required by 12.5.6 are fitted, the agreement of the Canadian Authority shall be obtained and the requirements of Pt 3, Ch 11, 5.1 General of the Rules for Ships shall apply.

**12.6 Engine room gangway doors**

12.6.1 For the definition of the engine room gangway door, see Ch 4, 1.4 Definitions.

12.6.2 These requirements cover cargo and service doors in the side shell plating in way of the engine room.

12.6.3 Engine room gangway doors shall be so fitted as to ensure tightness and structural integrity commensurate with their location and the surrounding structure.

12.6.4 Without the special agreement of the Canadian Authority, the lower edge of the door openings shall not be below a line drawn parallel to the freeboard deck at side, that has its lowest point at the upper edge of the uppermost load line.

12.6.5 When the doors open inward, the structure and closing arrangements will be specially considered.

12.6.6 Where an additional opening is arranged in the gangway door, then suitable closing arrangements are to be fitted.

12.6.7 The strength of the gangway doors is to comply with the requirements of Pt 3, Ch 11, 8.3 Scantlings of the Rules for Ships.

12.6.8 Doors are to be fitted with an adequate means of closing, securing and support so as to be commensurate with the strength and stiffness of the surrounding structure. The hull supporting structure in way of the doors is to be suitable for the same design loads and design stresses as the securing and supporting devices. Where packing is required the packing material is to be of a comparatively soft type and the supporting forces are to be carried by the steel structure only. The maximum design clearance between securing and supporting devices is generally not to exceed 3 mm.

## ■ *Section 13*

### **Ventilators, air pipes and discharges**

**13.1 General**

13.1.1 These requirements are to conform, where relevant, with the requirements of the Load Line Regulations (Inland) of the Canada Shipping Act.

**13.2 Protection**

13.2.1 In all cargo holds and deck areas where mechanical damage is likely, all air and sounding pipes, scuppers and discharges, including their valves, controls and indicators, are to be well protected. This protection is to be of steel or other equivalent material.

**13.3 Ventilators**

13.3.1 Special care is to be taken in the design and positioning of ventilator openings and coamings, particularly in the region on the strength deck in way of the cargo hatch openings.

13.3.2 Ventilators from deep tanks and tunnels passing through 'tween decks or superstructures are to have scantlings suitable for withstanding the pressures to which they may be subjected and are to be made watertight.

13.3.3 The requirements of Pt 3, Ch 12, 2.2 Coamings of the Rules for Ships are to be complied with, except the coaming height for ventilators in Position 1 and 2 shall be 760 mm and 610 mm, respectively.

13.3.4 All ventilator openings are to be provided with efficient, permanently attached, weathertight closing appliances unless, in Position 1 and 2, the coaming height exceeds 3,81 m and 1,83 m above the deck, respectively.

**13.4 Air pipes**

13.4.1 The requirements of Pt 3, Ch 12, 3 Air and sounding pipes of the Rules for Ships are to be complied with, except the coaming height for air pipes in Position 1 and 2 shall be 760 mm and 305 mm respectively.

## ■ Section 14 Equipment

**14.1 General**

14.1.1 To entitle a ship to be assigned the figure 1 in its character of classification, equipment in accordance with these requirements is to be provided.

14.1.2 The regulations governing the assignment of the character figure **1** for equipment are given in Pt 1, Ch 2, 2.2 Character symbols of the Rules for Ships.

14.1.3 For ships intended to be operated only in suitable areas or conditions which have been agreed by the Committee, as defined in Pt 1, Ch 2, 2.3 Class notations (hull) of the Rules for Ships or Pt 1, Ch 1, 2 Governance, equipment differing from these requirements may be approved, if considered suitable for the particular service on which the ship is to be assigned. See also Table 13.7.1 Equipment requirements of the Rules for Ships.

**14.2 Equipment Number**

14.2.1 The equipment of anchors and chain cables specified in 14.3 is based on an 'Equipment Number (NL)' which is to be calculated as follows:

14.2.2 The 'Equipment Number (NL)' to be used, is given by:

$$NL = 0,30L_{\Sigma} BD + \text{additions listed below}$$

- (a) for 1st tier superstructure or deckhouse, 17,6% of the product of their length, breadth and height in metres;
- (b) for 2nd tier deckhouses and other erections, 13,2% of the product of their length, breadth and height in metres, where  $L_{\Sigma}$  is given in Ch 4, 3.1 Definitions.

**14.3 Equipment requirements**

14.3.1 Each vessel is to be provided with two bower anchors of Table 4.14.1 Laker Equipment - Stockless Bower Anchors and Stud Link Chain Cable mass and 330 m, total length, of stud link chain cable of Table 4.14.1 Laker Equipment - Stockless Bower Anchors and Stud Link Chain Cable diameter.

**Table 4.14.1: Laker Equipment - Stockless Bower Anchors and Stud Link Chain Cable**

Equipment Number NL	Mass of each anchor, in kg	Mild steel (Grade 1 or U1) Diameter in mm	special quality steel (Grade U2) Diameter in mm	Extra special quality steel (Grade U3) Diameter in mm
2000	1700	42	36	32

# Ship Structures

## Chapter 4

### Section 14

2500	1815	42	36	32
3000	2040	44	38	34
3500	2155	48	42	36
4000	2270	49	43	36
4500	2380	50	44	38
5000	2610	52	46	40
5500	2720	52	46	40
6000	2860	52	46	40
6500	2950	52	46	40
7000	3060	54	48	42
7500	3175	54	48	42
8000	3290	54	48	42
8500	3290	56	50	44
9000	3445	56	50	44
9500	3445	58	50	46
10000	3675	58	50	46
10750	3900	58	50	46
11500	3900	60	52	46
12250	4080	60	52	46
13000	4080	62	54	48
13750	4310	62	54	48
14500	4535	62	54	48
15250	4535	64	56	50
16000	4535	64	56	50
16750	4535	64	56	50
17500	4990	65	57	50
18250	4990	65	57	50
19000	4990	65	57	50
19750	4990	66	58	50
20500	5445	66	58	50
21250	5445	68	60	52
22000	5445	68	60	52
23000	5895	68	60	52
24000	5895	70	62	54
25000	5895	70	62	54
26000	6350	70	62	54
27000	6350	73	64	56
28000	6350	73	64	56



# Ship Structures

## Chapter 4

### Section 14

29000	6805	73	64	56
30000	6805	75	65	57
31500	7260	75	65	57
33000	7260	75	65	57
34500	7260	76	66	58
36000	8165	76	66	58
37500	8165	76	66	58
39000	8165	76	66	58
40500	8165	78	68	60
42000	9070	78	68	60
44000	9070	78	68	60
46000	9070	81	70	62
48000	9070	81	70	62
50000	10205	81	70	62
52000	10205	83	71	62
54000	10205	84	73	64
56000	11340	84	73	64
58000	11340	84	73	64
60000	11340	86	75	65
62000	11340	86	75	65
64000	12475	86	75	65
66000	12475	86	75	65
68000	12475	87	76	66
70000	12475	87	76	66

14.3.2 The stern anchor is required to be fitted in accordance with the requirements of the St. Lawrence Seaway Authority.

14.3.3 Minimum guidelines from the St. Lawrence Seaway Management Corporation for a ship to transit the St. Lawrence River are given in *The Seaway Handbook*, see Ch 4, 1.1 Application.

#### 14.4 Anchors

14.4.1 Anchors are to be in accordance with the requirements of Pt 3, Ch 13, 7.2 Anchors and Pt 3, Ch 13, 7.3 High holding power anchors of the Rules for Ships.

#### 14.5 Chain cable

14.5.1 Chain cable is to be in accordance with the requirements of Pt 3, Ch 13, 7.4 Chain cables of the Rules for Ships.

#### 14.6 Towlines and mooring lines

14.6.1 Ships over 90 m in length do not require towlines and mooring lines as a classification item. Other requirements of Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length of the Rules for Ships are applicable.

#### 14.7 Windlass design, testing and structural requirements

14.7.1 The windlass design, testing and structural requirements are to be in accordance with Pt 3, Ch 13, 7.6 Towlines and mooring lines for ships over 90 m in length of the Rules for Ships.

### **14.8 Testing of equipment**

14.8.1 Equipment is to be tested in accordance with Pt 3, Ch 13, 8.1 Windlass design of the Rules for Ships.

### **14.9 Structural arrangements of windlass and chain lockers**

14.9.1 The structural arrangements of the windlass and the chain lockers are to be in accordance with Pt 3, Ch 13, 8.8 Winch design and testing of the Rules for Ships.

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